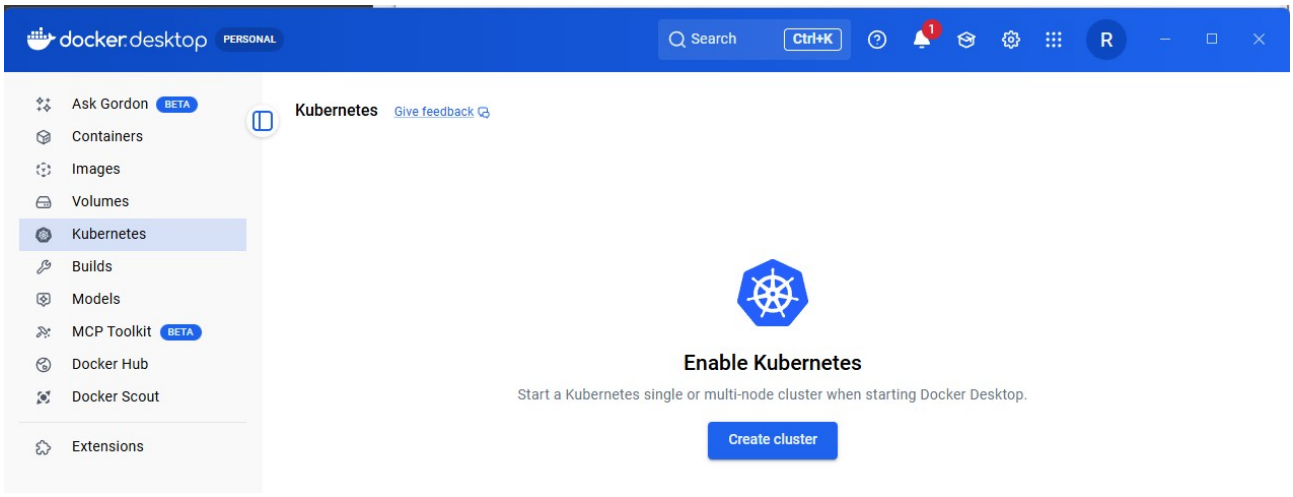
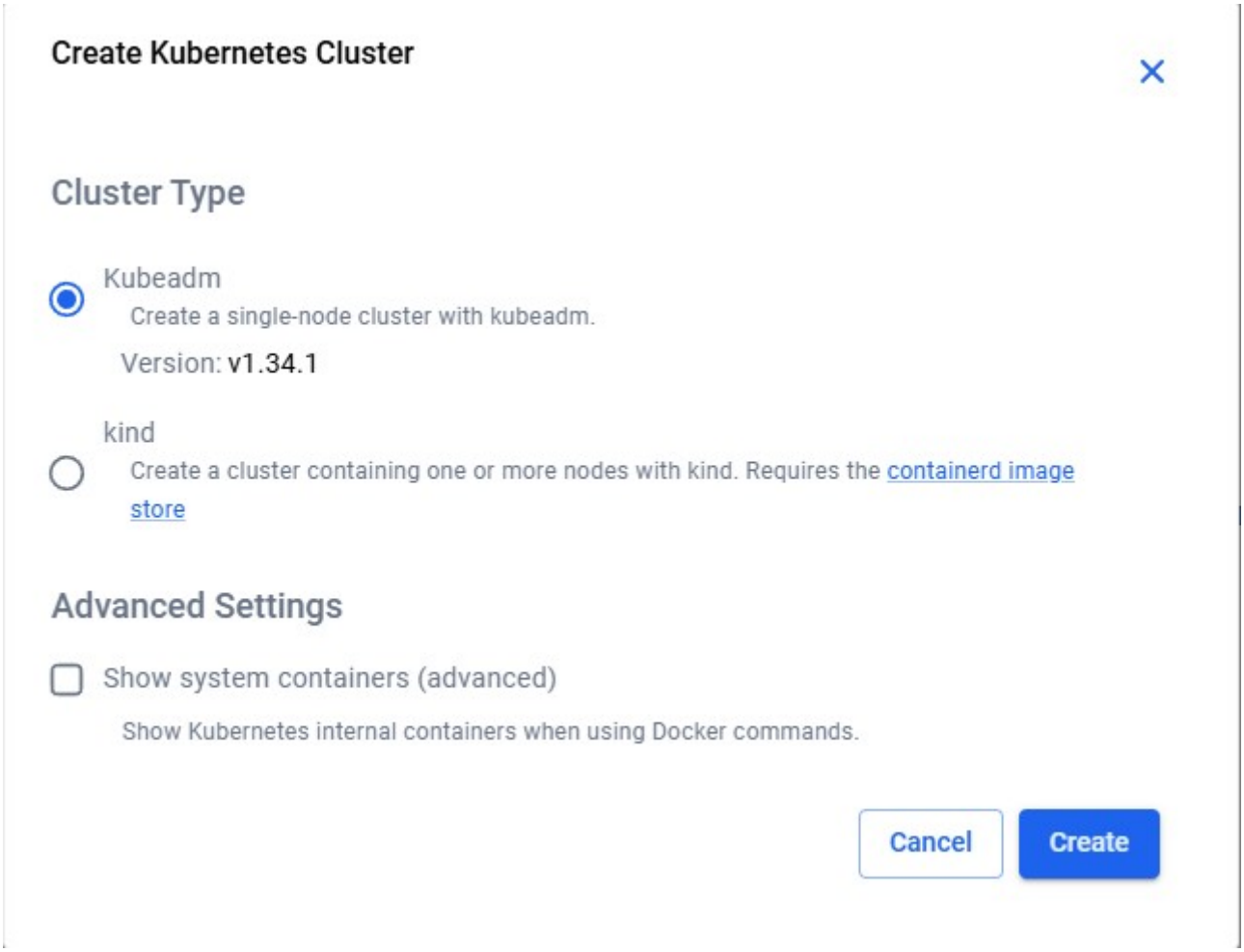
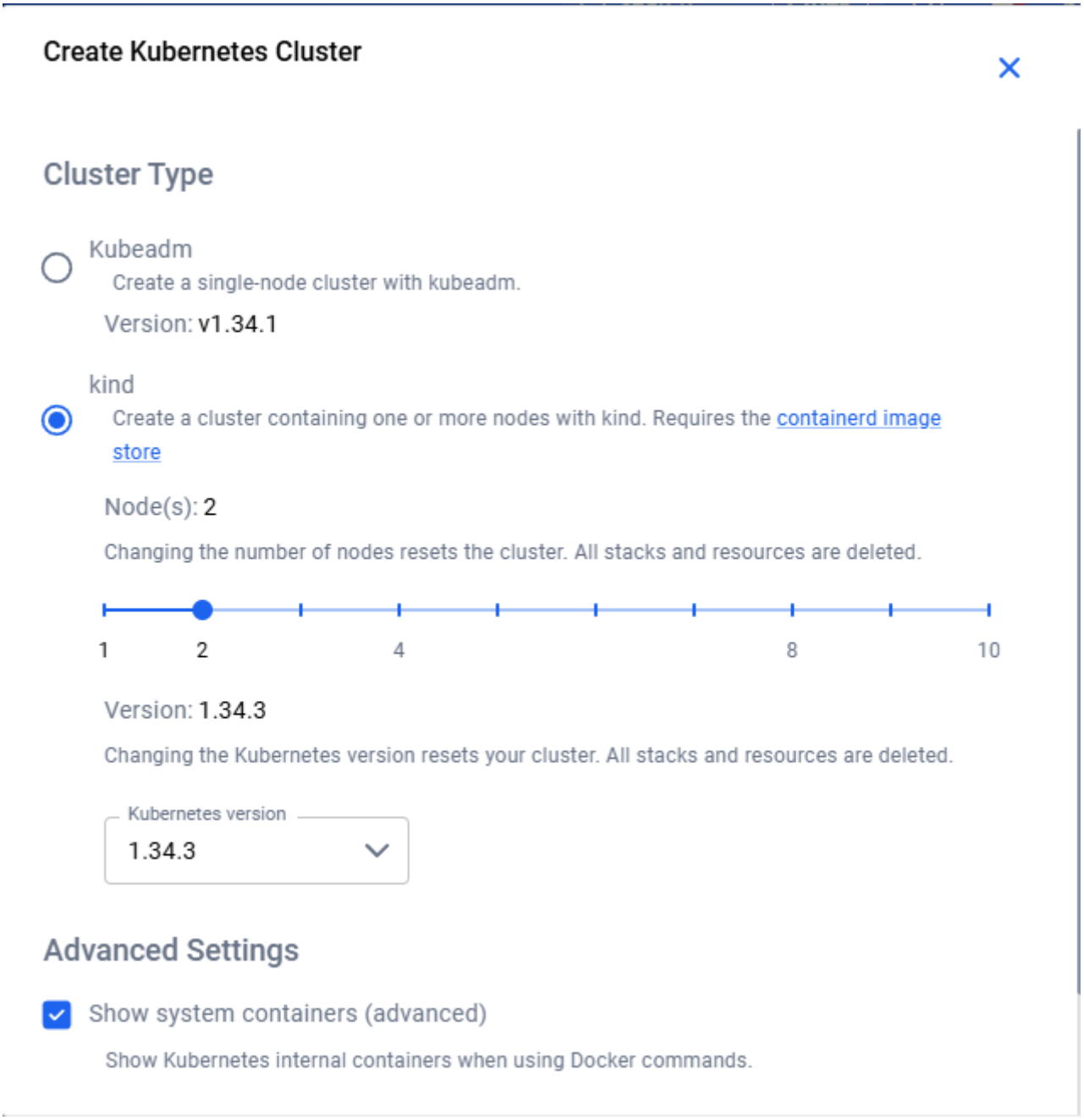
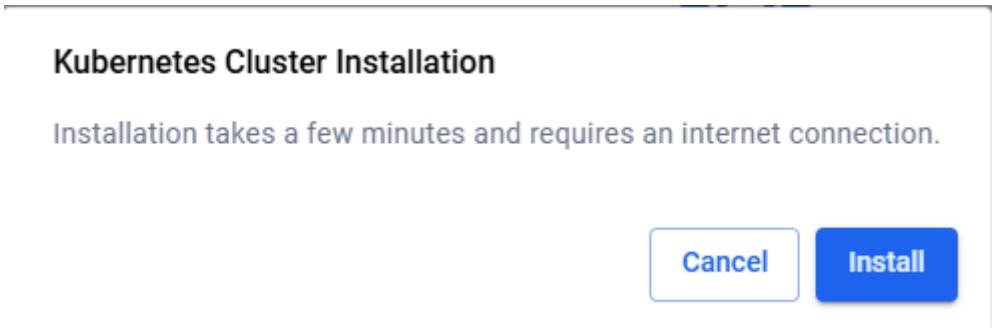
Chapitre 5 – Kubernetes : plateforme de déploiement des applications conteneurisées

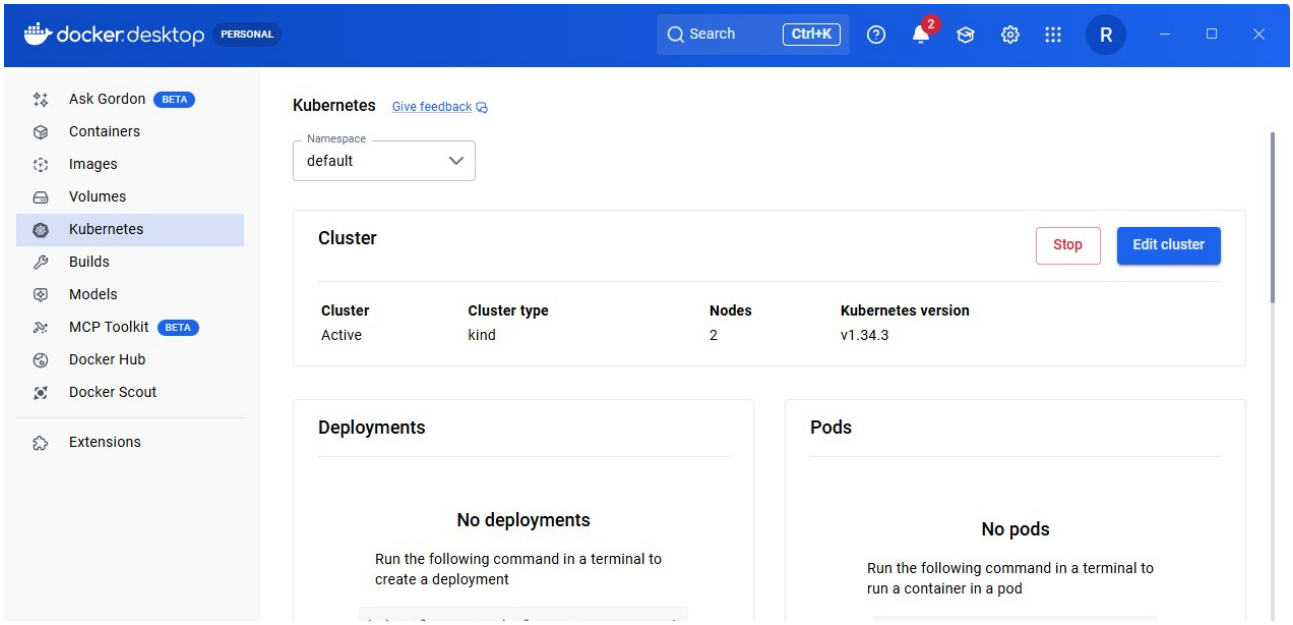
1. Kubernetes avec Docker Desktop.

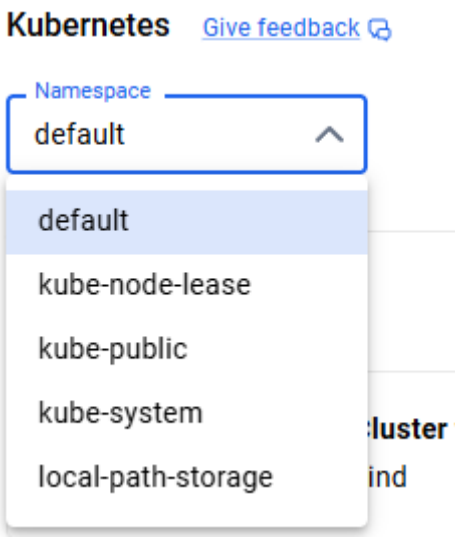




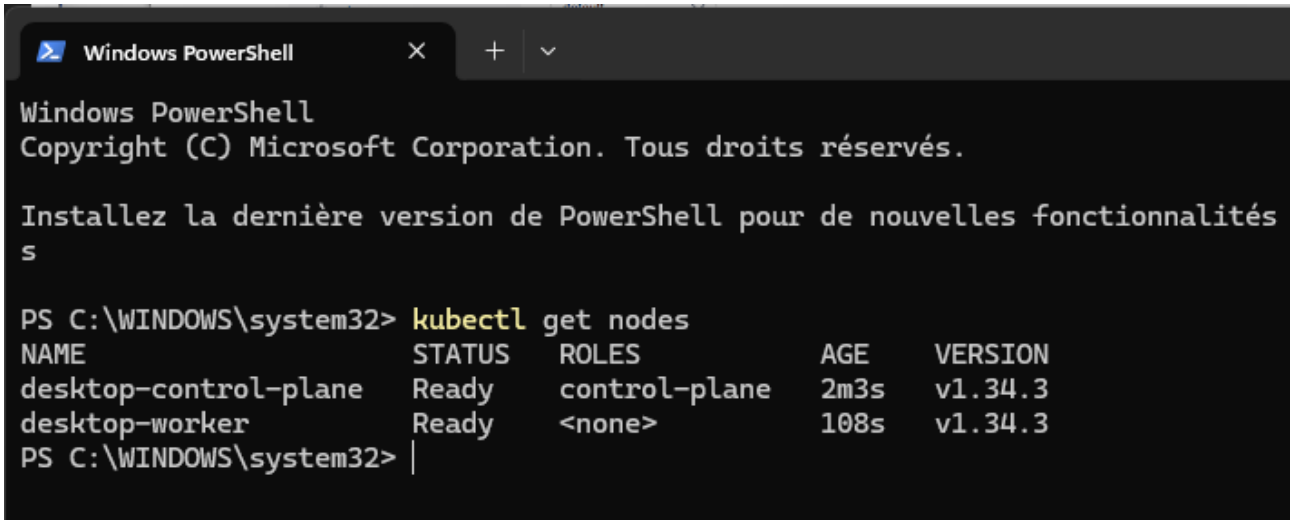

Create Kubernetes Cluster
Cluster Type
Kubeadm
Create a single-node cluster with kubeadm.
Version: v1.34.1
kind
Create a cluster containing one or more nodes with kind. Requires the containerd image store
Node(s): 2
Changing the number of nodes resets the cluster. All stacks and resources are deleted.
1
2
4
8
10
Version: 1.34.3
Changing the Kubernetes version resets your cluster. All stacks and resources are deleted.
Kubernetes version
1.34.3
Advanced Settings
Show system containers (advanced)
Show Kubernetes internal containers when using Docker commands.

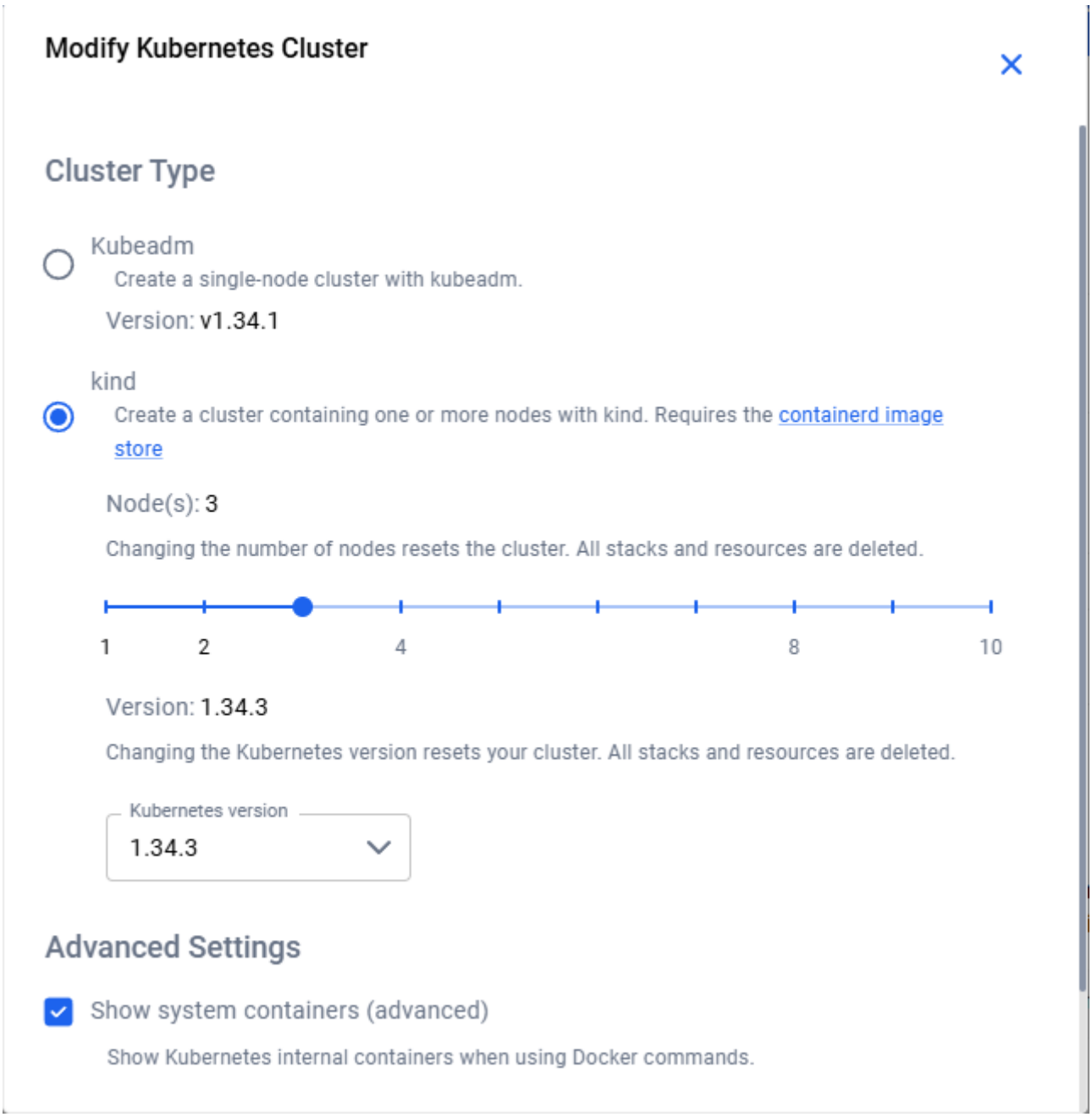

Kubernetes Cluster Installation
Installation takes a few minutes and requires an internet connection.
Cancel
Install

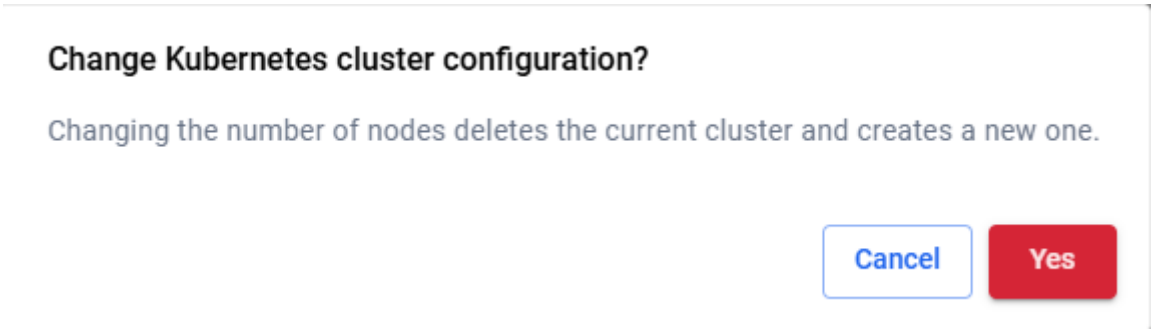


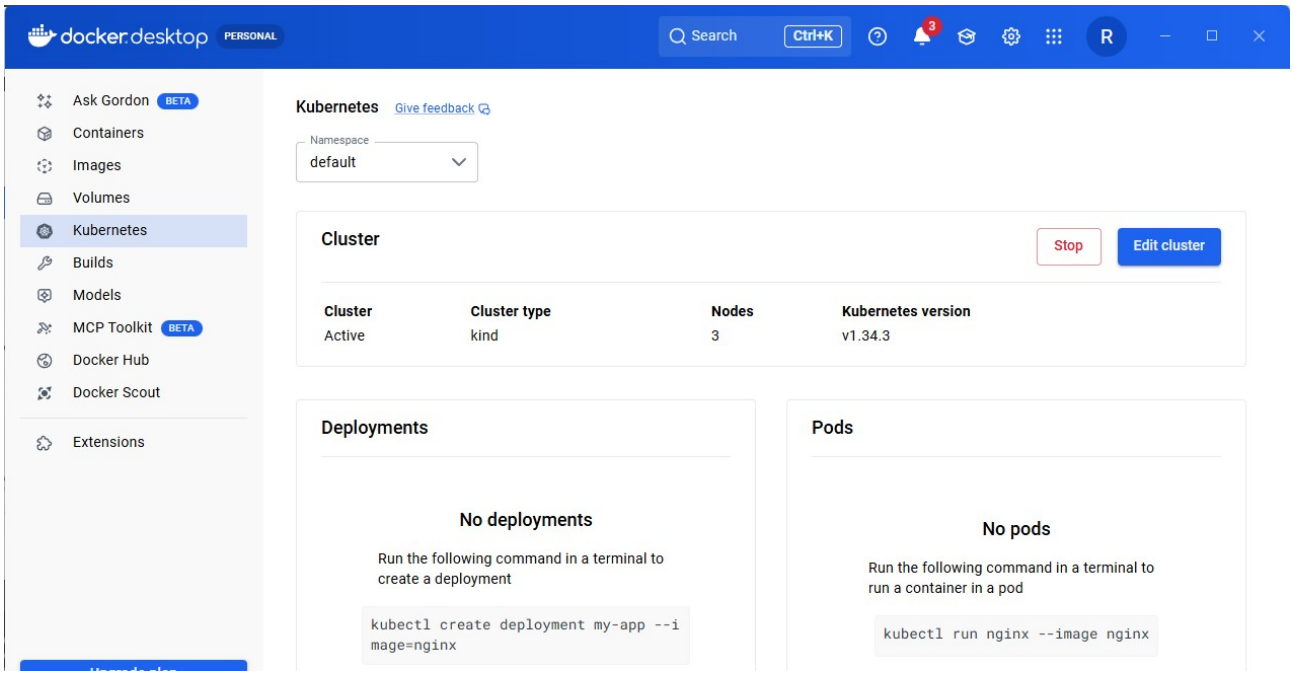


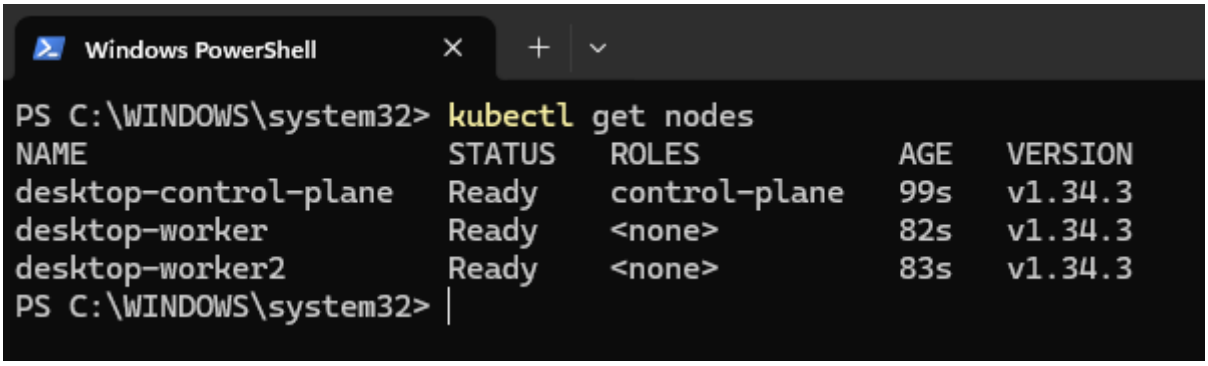
2 nœuds : un maître et un worker

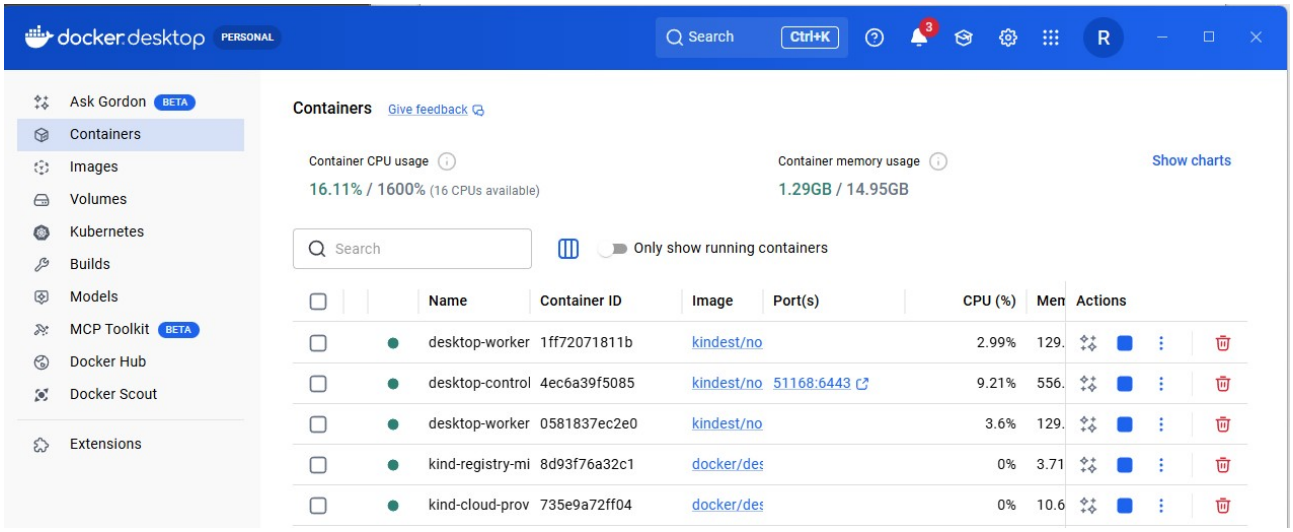



Modify Kubernetes Cluster
Cluster Type
Kubeadm
Create a single-node cluster with kubeadm.
Version: v1.34.1
kind
Create a cluster containing one or more nodes with kind. Requires the containerd image store
Node(s): 3
Changing the number of nodes resets the cluster. All stacks and resources are deleted.
1
2
4
8
10
Version: 1.34.3
Changing the Kubernetes version resets your cluster. All stacks and resources are deleted.
Kubernetes version
1.34.3
Advanced Settings
Show system containers (advanced)
Show Kubernetes internal containers when using Docker commands.


Change Kubernetes cluster configuration?
Changing the number of nodes deletes the current cluster and creates a new one.
Cancel
Yes

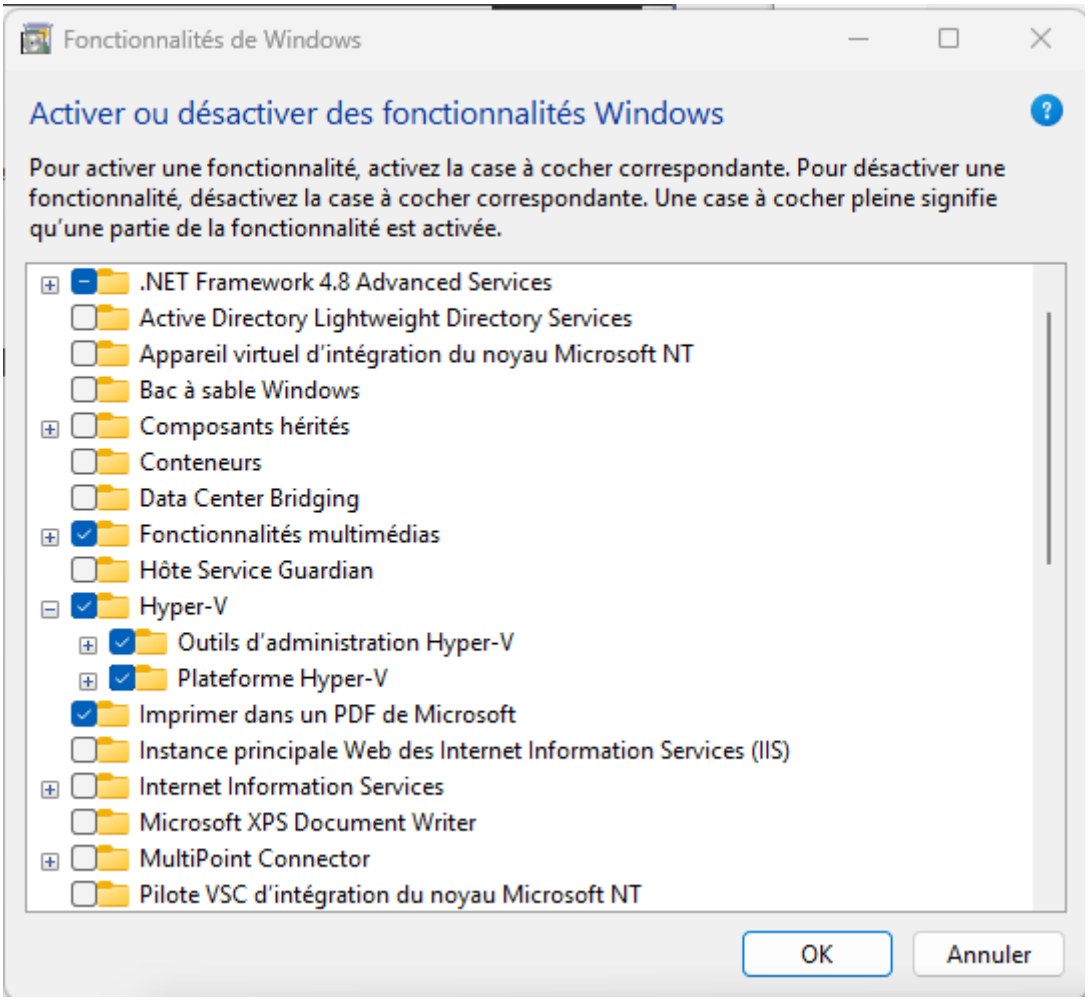

docker desktop
PERSONAL
Search
Ctrl+K
Ask Gordon
BETA
Containers
Images
Volumes
Kubernetes
Builds
Models
MCP Toolkit
BETA
Docker Hub
Docker Scout
Extensions
Kubernetes
Give feedback
Namespace
default
Cluster
Stop
Edit cluster
Cluster
Active
Cluster type
kind
Nodes
3
Kubernetes version
v1.34.3
Deployments
No deployments
Run the following command in a terminal to create a deployment
kubectl create deployment my-app --image=nginx
Pods
No pods
Run the following command in a terminal to run a container in a pod
kubectl run nginx --image nginx


Windows PowerShell
PS C:\WINDOWS\system32> kubectl get nodes
NAME STATUS ROLES AGE VERSION
desktop-control-plane Ready control-plane 99s v1.34.3
desktop-worker Ready <none> 82s v1.34.3
desktop-worker2 Ready <none> 83s v1.34.3
PS C:\WINDOWS\system32>


docker desktop
PERSONAL
Search
Ctrl+K
Ask Gordon
BETA
Containers
Images
Volumes
Kubernetes
Builds
Models
MCP Toolkit
BETA
Docker Hub
Docker Scout
Extensions
Containers
Give feedback
Container CPU usage
16.11% / 1600% (16 CPUs available)
Container memory usage
1.29GB / 14.95GB
Show charts
Search
Only show running containers
Name
Container ID
Image
Port(s)
CPU (%)
Mem
Actions
desktop-worker 1ff72071811b kindest/no 2.99% 129.
desktop-control 4ec6a39f5085 kindest/no 51168:6443 9.21% 556.
desktop-worker 0581837ec2e0 kindest/no 3.6% 129.
kind-registry-mi 8d93f76a32c1 docker/des 0% 3.71
kind-cloud-prov 735e9a72ff04 docker/des 0% 10.6

2. Installation de Minikube.

1) Activer la fonctionnalité Windows Hyper-V :



2) Installer Minikube

minikube start

minikube is local Kubernetes, focusing on making it easy to learn and develop for Kubernetes.

All you need is Docker (or similarly compatible) container or a Virtual Machine environment, and Kubernetes is a single command away: `minikube start`

What you'll need

- 2 CPUs or more
- 2GB of free memory
- 20GB of free disk space
- Internet connection
- Container or virtual machine manager, such as: Docker, QEMU, Hyperkit, Hyper-V, KVM, Parallels, Podman, VirtualBox, or VMware Fusion/Workstation

1 Installation

Click on the buttons that describe your target platform. For other architectures, see the release page for a complete list of minikube binaries.

Operating system	Linux	macOS	**Windows**	Try in Browser
Architecture	**x86-64**			
Release type	**Stable**			
Installer type	**.exe download**	Windows Package Manager	Chocolatey	

To install the latest minikube **stable** release on **x86-64 Windows** using **.exe download**:

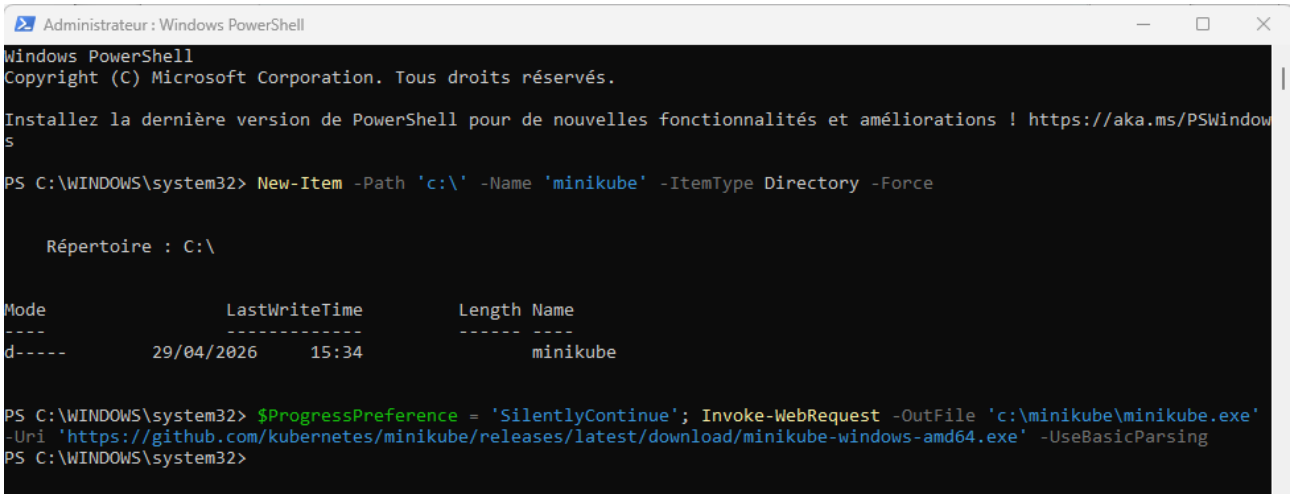
1. Download and run the installer for the latest release.
   Or if using `PowerShell`, use this command:

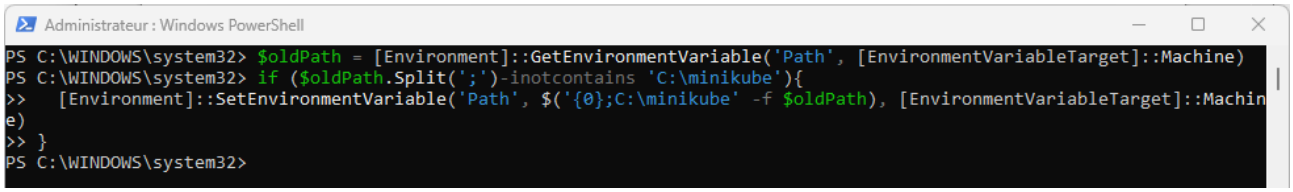
```
New-Item -Path 'c:\' -Name 'minikube' -ItemType Directory -Force
$ProgressPreference = 'SilentlyContinue'; Invoke-WebRequest -OutFile 'c:\minikube\minikube.exe
```

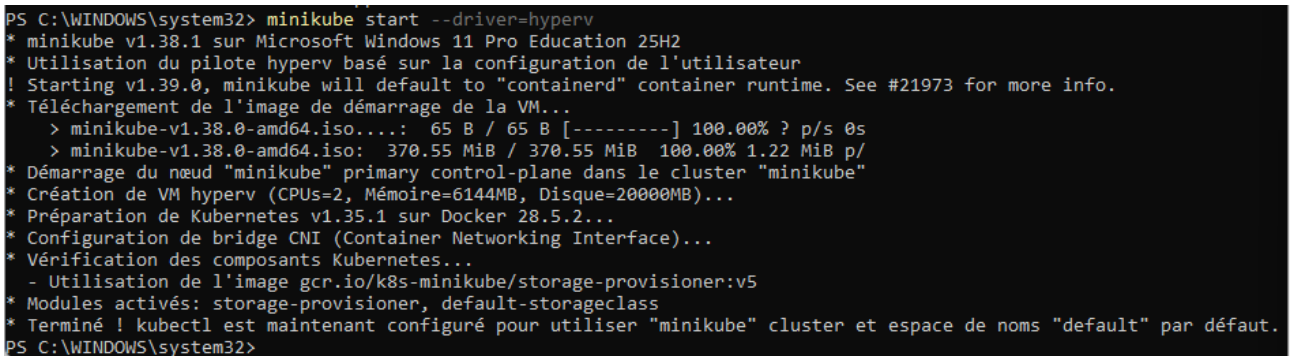
2. Add the `minikube.exe` binary to your `PATH`.
   Make sure to run PowerShell as Administrator.

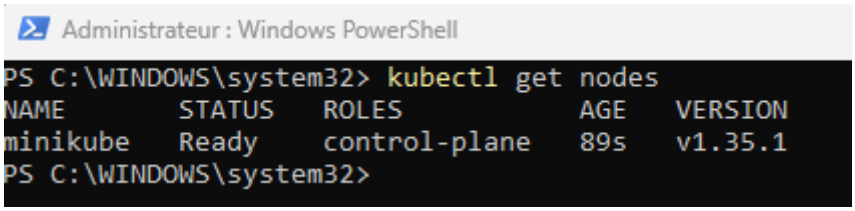
```
$oldPath = [Environment]::GetEnvironmentVariable('Path', [EnvironmentVariableTarget]::Machine
if ($oldPath.Split(';') -inotcontains 'C:\minikube'){
  [Environment]::SetEnvironmentVariable('Path', $('{0};C:\minikube' -f $oldPath), [Environmen
}
```

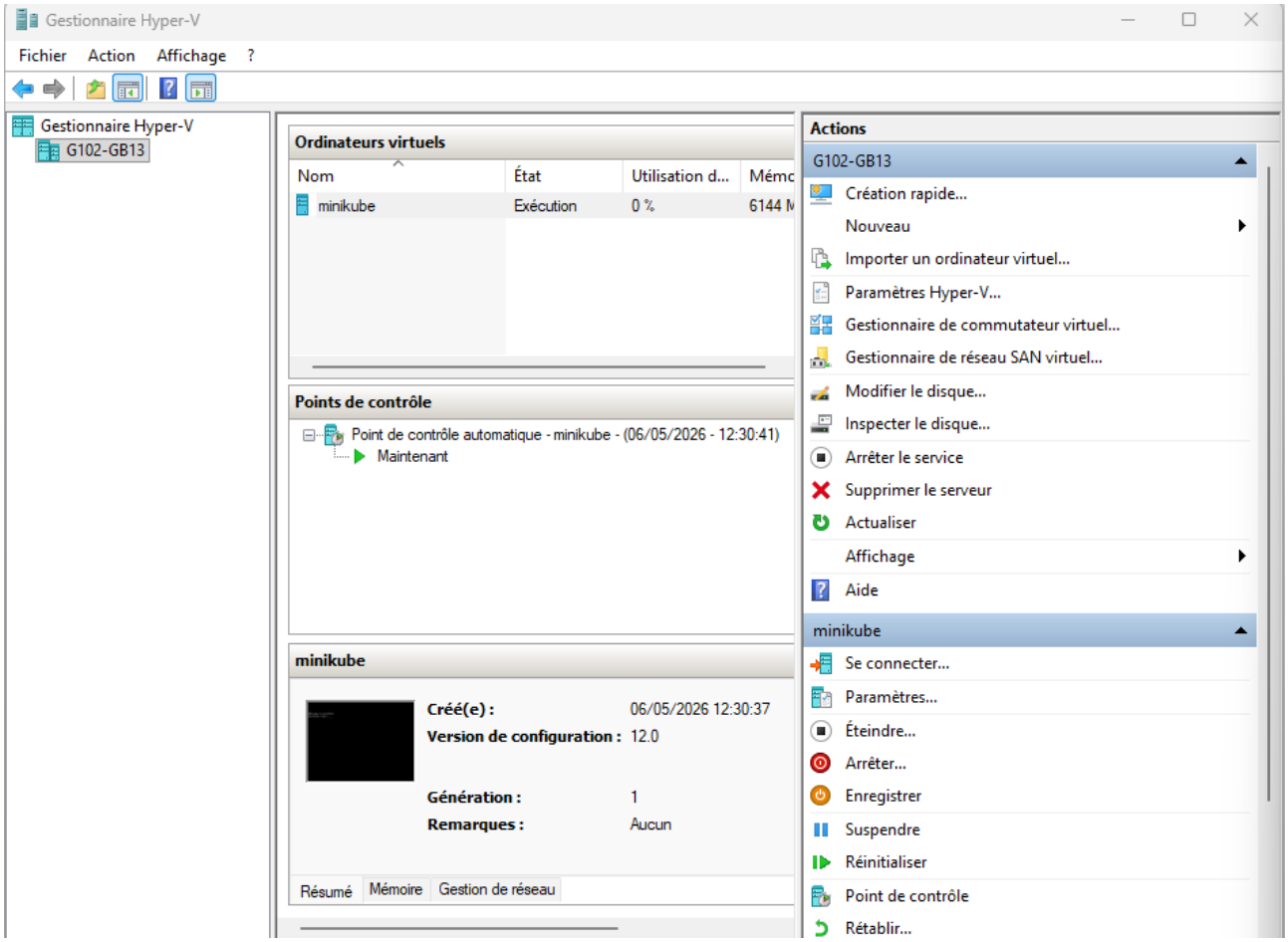
If you used a terminal (like powershell) for the installation, please close the terminal and reopen it before running minikube.


Administrateur : Windows PowerShell
Windows PowerShell
Copyright (C) Microsoft Corporation. Tous droits réservés.
Installez la dernière version de PowerShell pour de nouvelles fonctionnalités et améliorations ! https://aka.ms/PSWindows
PS C:\WINDOWS\system32> New-Item -Path 'c:\' -Name 'minikube' -ItemType Directory -Force
Répertoire : C:\
Mode LastWriteTime Length Name
d----- 29/04/2026 15:34 minikube
PS C:\WINDOWS\system32> $ProgressPreference = 'SilentlyContinue'; Invoke-WebRequest -OutFile 'c:\minikube\minikube.exe' -Uri 'https://github.com/kubernetes/minikube/releases/latest/download/minikube-windows-amd64.exe' -UseBasicParsing
PS C:\WINDOWS\system32>

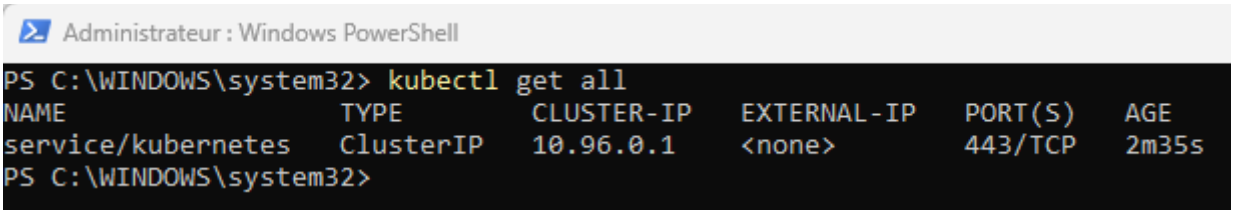

Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> $oldPath = [Environment]::GetEnvironmentVariable('Path', [EnvironmentVariableTarget]::Machine)
PS C:\WINDOWS\system32> if ($oldPath.Split(';')-inotcontains 'C:\minikube'){
>> [Environment]::SetEnvironmentVariable('Path', $('{0};C:\minikube' -f $oldPath), [EnvironmentVariableTarget]::Machine)
>> }
PS C:\WINDOWS\system32>


PS C:\WINDOWS\system32> minikube start --driver=hyperv
* minikube v1.38.1 sur Microsoft Windows 11 Pro Education 25H2
* Utilisation du pilote hyperv basé sur la configuration de l'utilisateur
! Starting v1.39.0, minikube will default to "containerd" container runtime. See #21973 for more info.
* Téléchargement de l'image de démarrage de la VM...
> minikube-v1.38.0-amd64.iso....: 65 B / 65 B [---------] 100.00% ? p/s 0s
> minikube-v1.38.0-amd64.iso: 370.55 MiB / 370.55 MiB 100.00% 1.22 MiB p/
* Démarrage du nœud "minikube" primary control-plane dans le cluster "minikube"
* Création de VM hyperv (CPUs=2, Mémoire=6144MB, Disque=20000MB)...
* Préparation de Kubernetes v1.35.1 sur Docker 28.5.2...
* Configuration de bridge CNI (Container Networking Interface)...
* Vérification des composants Kubernetes...
- Utilisation de l'image gcr.io/k8s-minikube/storage-provisioner:v5
* Modules activés: storage-provisioner, default-storageclass
* Terminé ! kubectl est maintenant configuré pour utiliser "minikube" cluster et espace de noms "default" par défaut.
PS C:\WINDOWS\system32>

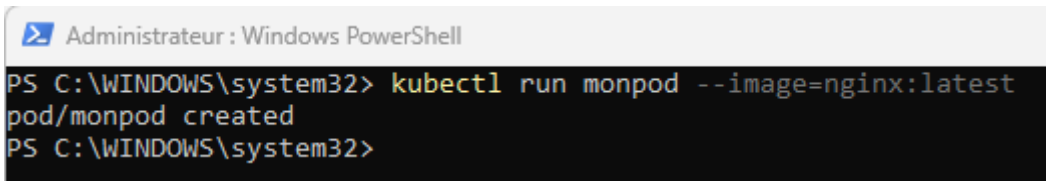

Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get nodes
NAME STATUS ROLES AGE VERSION
minikube Ready control-plane 89s v1.35.1
PS C:\WINDOWS\system32>

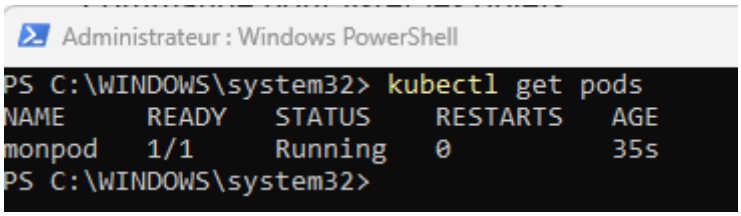


Commande pour lister les objets :



Mon premier objet (type pod) : créer un pod nginx via kubectl :





```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get all
NAME         READY   STATUS    RESTARTS   AGE
pod/monpod   1/1     Running   0          62s

NAME                 TYPE        CLUSTER-IP   EXTERNAL-IP   PORT(S)   AGE
service/kubernetes   ClusterIP   10.96.0.1    <none>        443/TCP   4m42s
PS C:\WINDOWS\system32>
```

Consulter le log d'un pod :

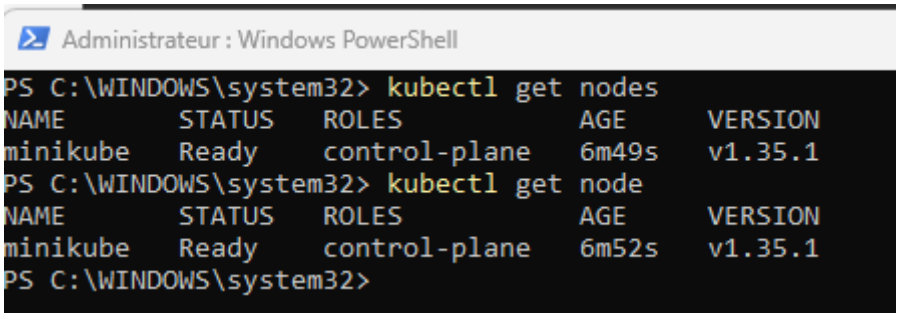
```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl logs pod/monpod
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration
/docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
/docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh
10-listen-on-ipv6-by-default.sh: info: Getting the checksum of /etc/nginx/conf.d/default.conf
10-listen-on-ipv6-by-default.sh: info: Enabled listen on IPv6 in /etc/nginx/conf.d/default.conf
/docker-entrypoint.sh: Sourcing /docker-entrypoint.d/15-local-resolvers.envsh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/30-tune-worker-processes.sh
/docker-entrypoint.sh: Configuration complete; ready for start up
2026/05/06 10:35:16 [notice] 1#1: using the "epoll" event method
2026/05/06 10:35:16 [notice] 1#1: nginx/1.29.8
2026/05/06 10:35:16 [notice] 1#1: built by gcc 14.2.0 (Debian 14.2.0-19)
2026/05/06 10:35:16 [notice] 1#1: OS: Linux 6.6.95
2026/05/06 10:35:16 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2026/05/06 10:35:16 [notice] 1#1: start worker processes
2026/05/06 10:35:16 [notice] 1#1: start worker process 29
2026/05/06 10:35:16 [notice] 1#1: start worker process 30
PS C:\WINDOWS\system32>
```

Les espaces de noms dans lesquels sont créés les objets :

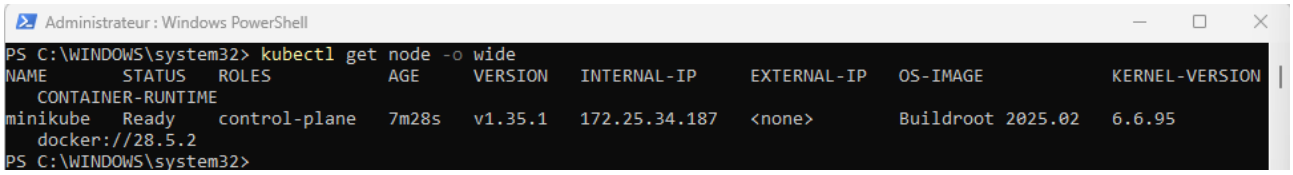
```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get namespace
NAME              STATUS   AGE
default           Active   5m59s
kube-node-lease   Active   5m59s
kube-public       Active   5m59s
kube-system       Active   5m59s
PS C:\WINDOWS\system32>
```

Les objets : singulier ou pluriel, peu importe

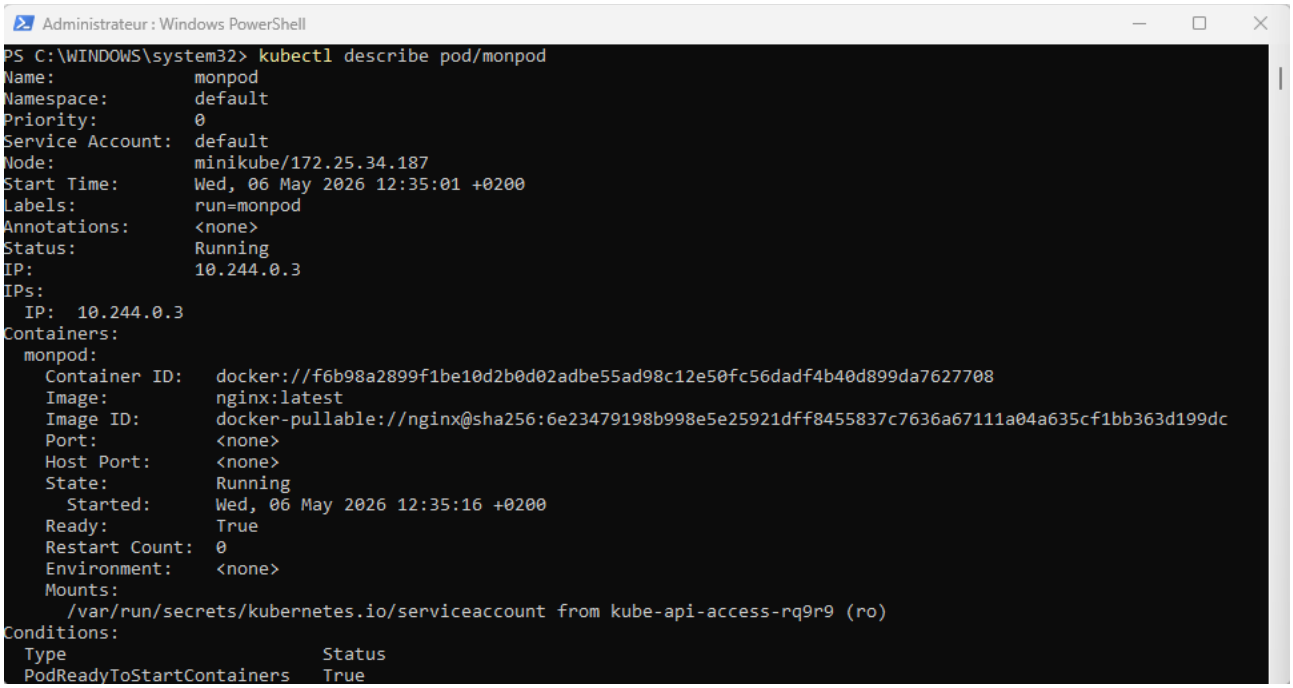
```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get pods
NAME     READY   STATUS    RESTARTS   AGE
monpod   1/1     Running   0          2m45s
PS C:\WINDOWS\system32> kubectl get pod
NAME     READY   STATUS    RESTARTS   AGE
monpod   1/1     Running   0          2m47s
PS C:\WINDOWS\system32>
```

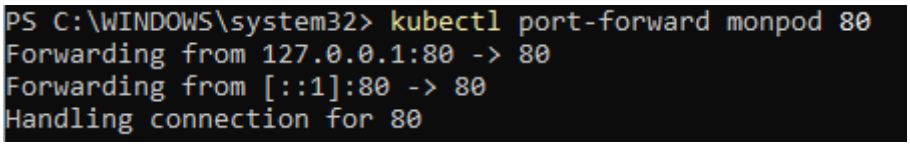


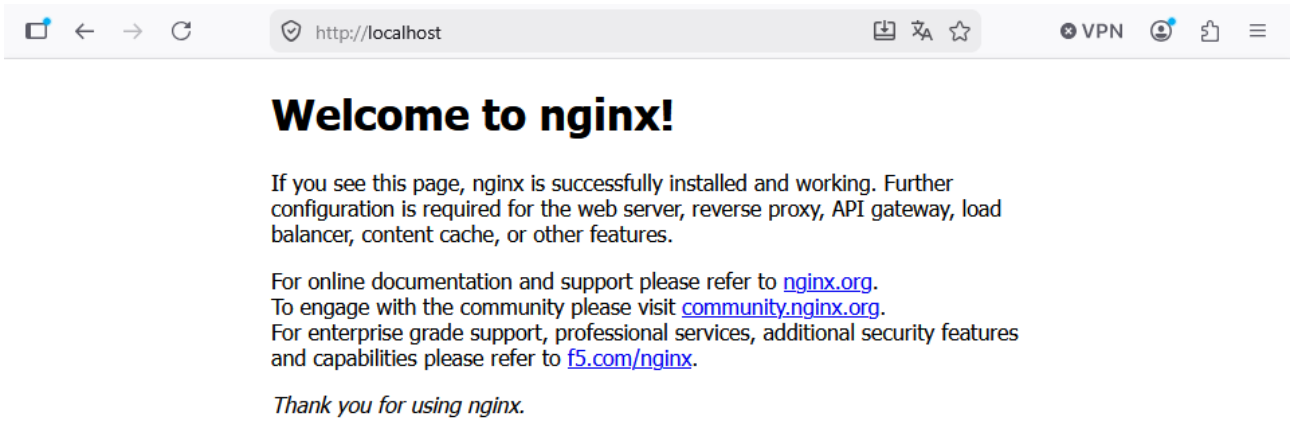
Champs supplémentaires :



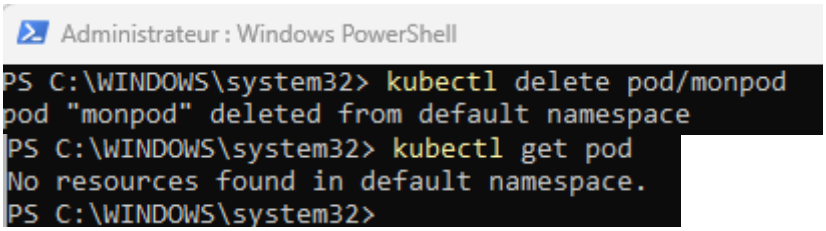
Accéder à Minikube et interroger le démon containerd (commande ctr précédée de sudo afin de récupérer la liste des espaces de noms). Dans le cas où Docker est utilisé comme moteur de conteneur, l'espace de noms porte la valeur moby :





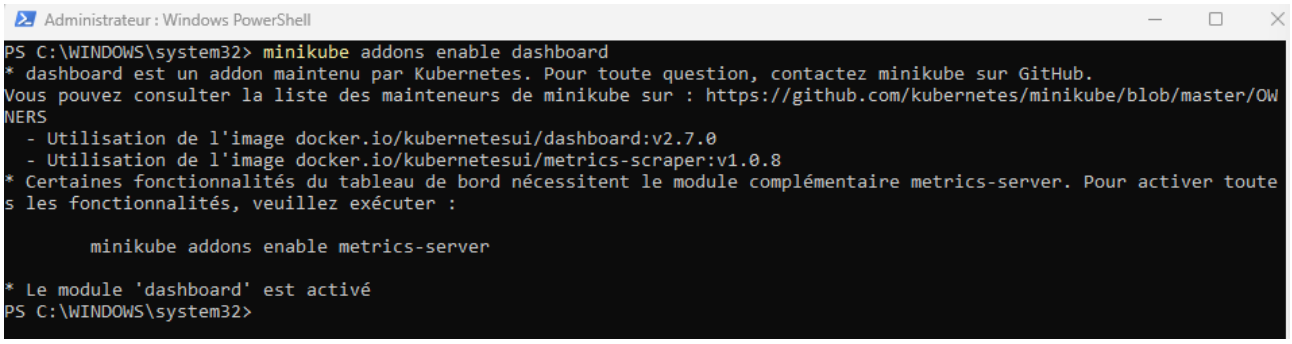


Détruire le pod nginx :

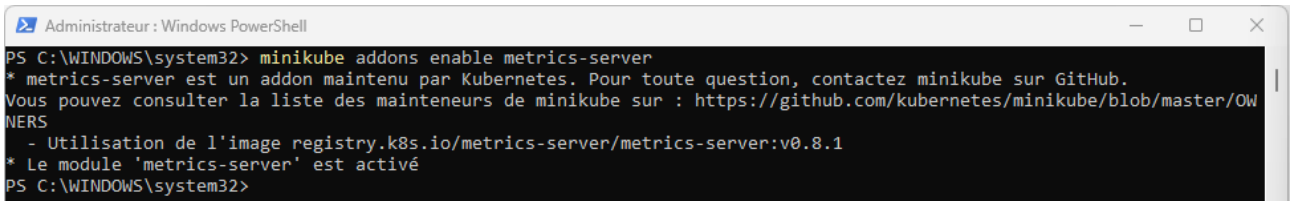


3. Le tableau de bord de Kubernetes.

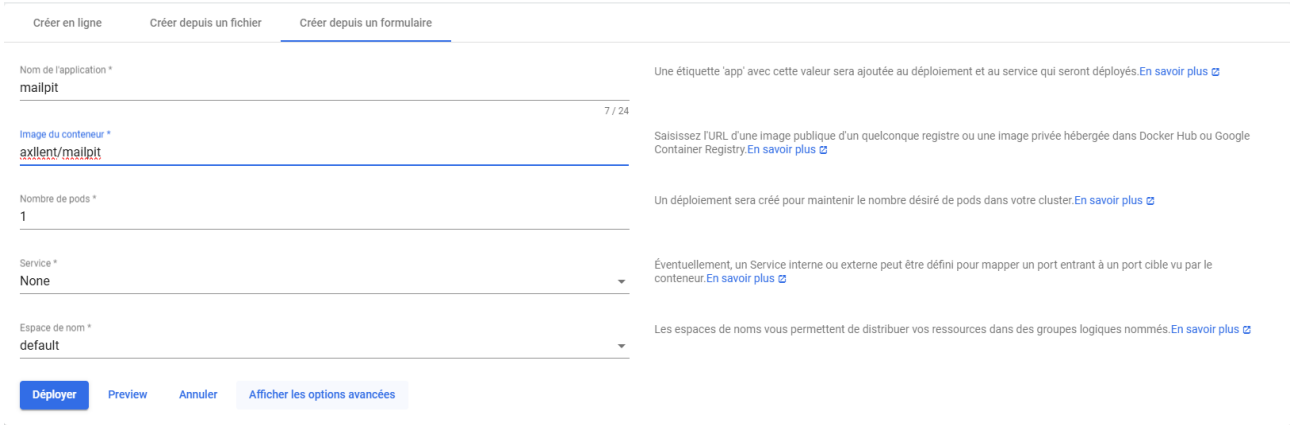
Activer le plugin :

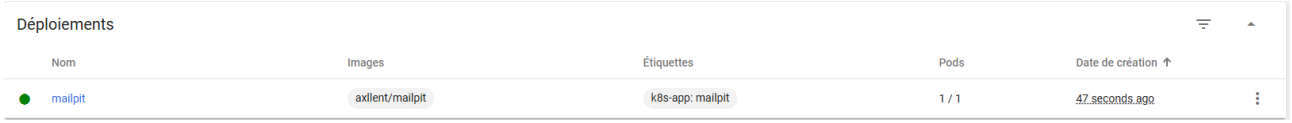


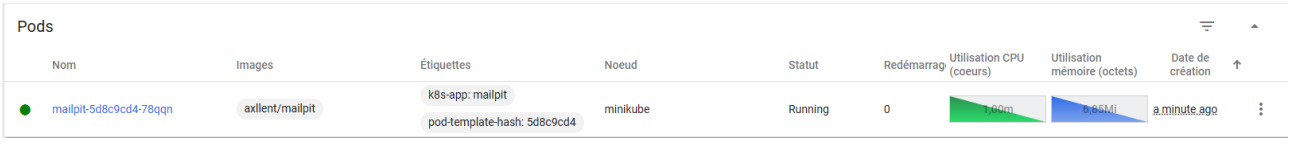
Comme indiqué ci-dessus, activer le serveur de métriques pour bénéficier de l'ensemble des fonctionnalités du tableau de bord :

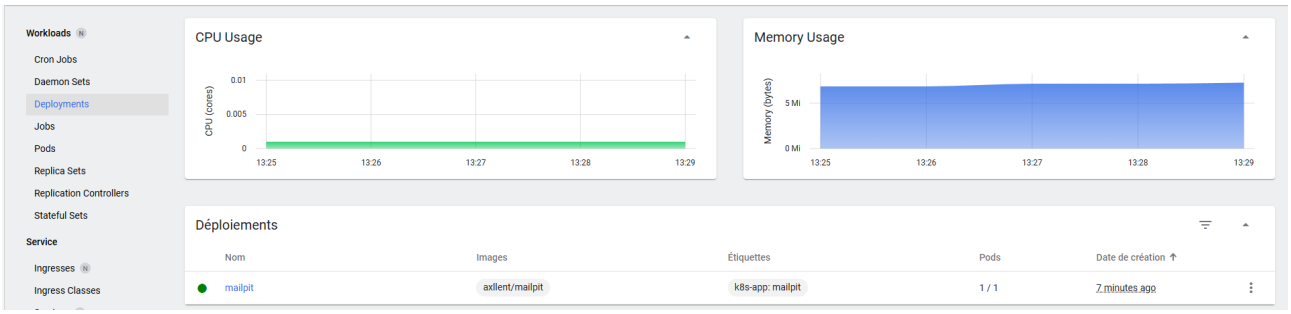


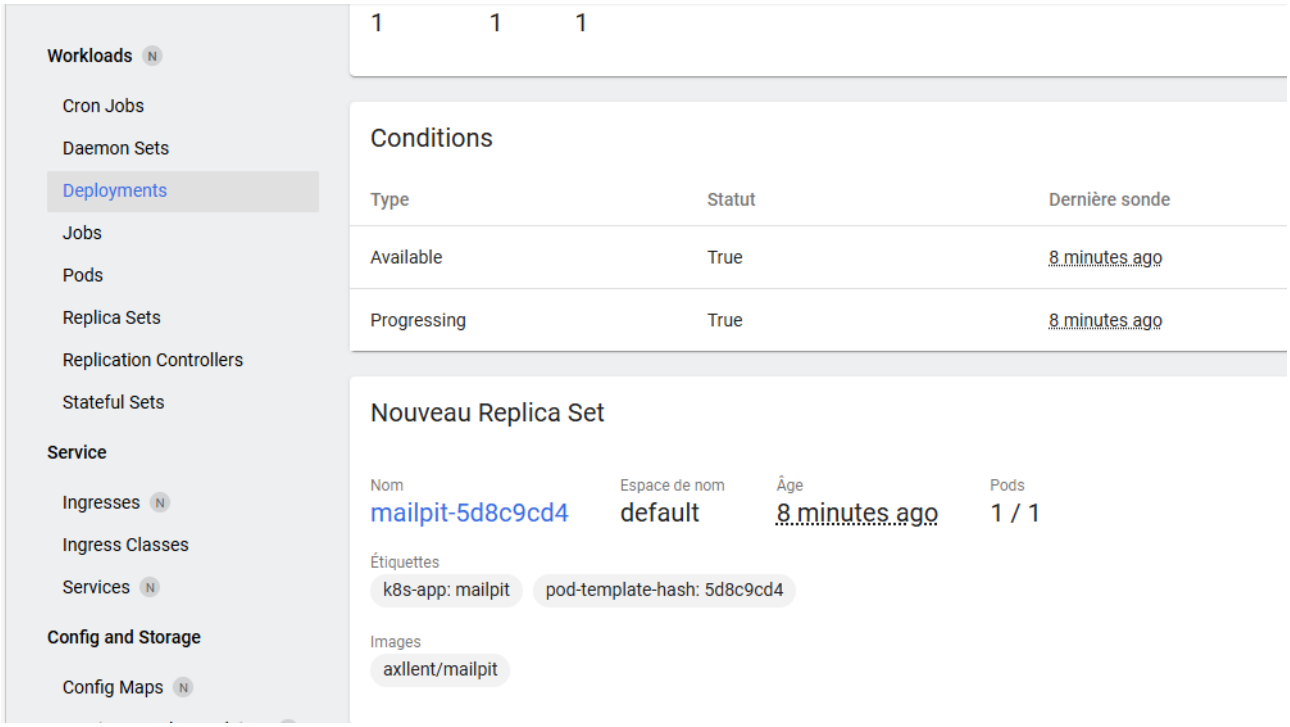
Accès au tableau de bord :

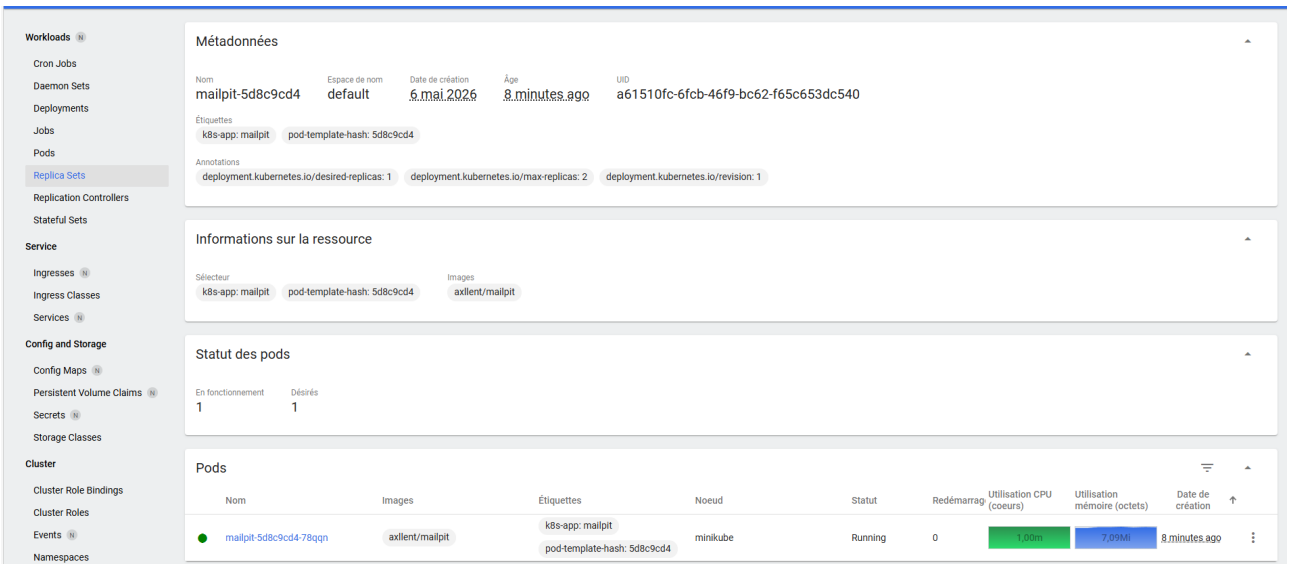




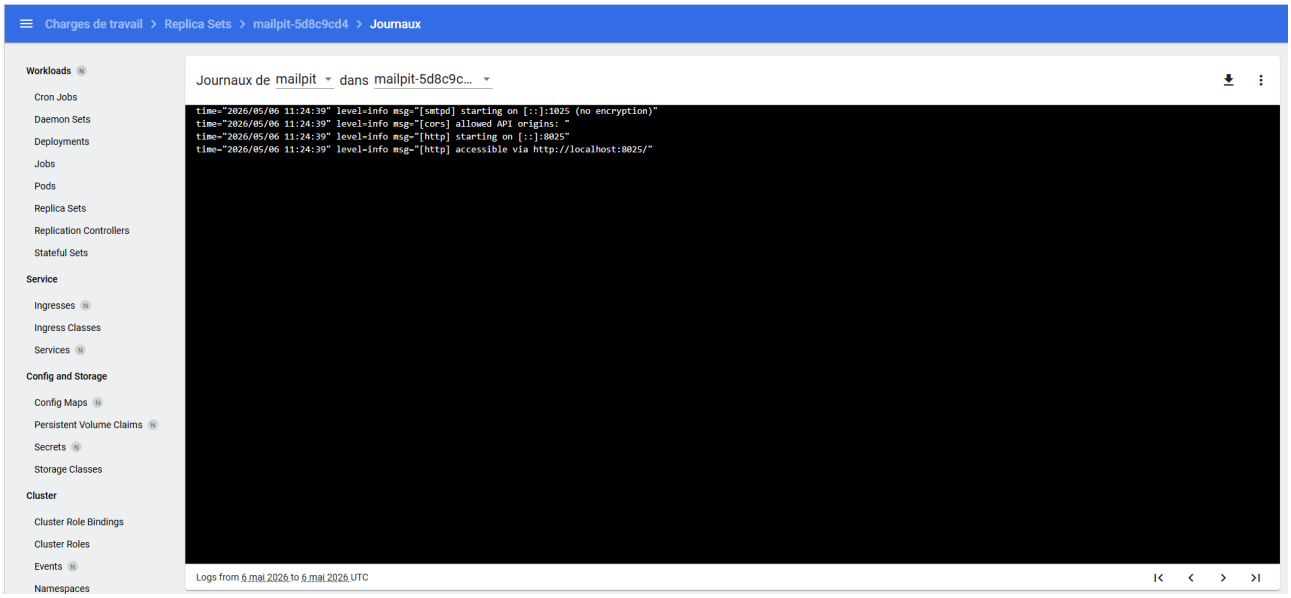

Pods
Nom
Images
Étiquettes
Noeud
Statut
Redémarrag
Utilisation CPU (coeurs)
Utilisation mémoire (octets)
Date de création
mailpit-5d8c9cd4-78qqn
axllent/mailpit
k8s-app: mailpit
pod-template-hash: 5d8c9cd4
minikube
Running
0
a minute ago


Workloads
Cron Jobs
Daemon Sets
Deployments
Jobs
Pods
Replica Sets
Replication Controllers
Stateful Sets
Service
Ingresses
Ingress Classes
CPU Usage
CPU (cores)
0.01
0.005
0
13:25
13:26
13:27
13:28
13:29
Memory Usage
Memory (bytes)
5 Mi
0 Mi
Déploiements
Nom
Images
Étiquettes
Pods
Date de création
mailpit
axllent/mailpit
k8s-app: mailpit
1 / 1
7 minutes ago

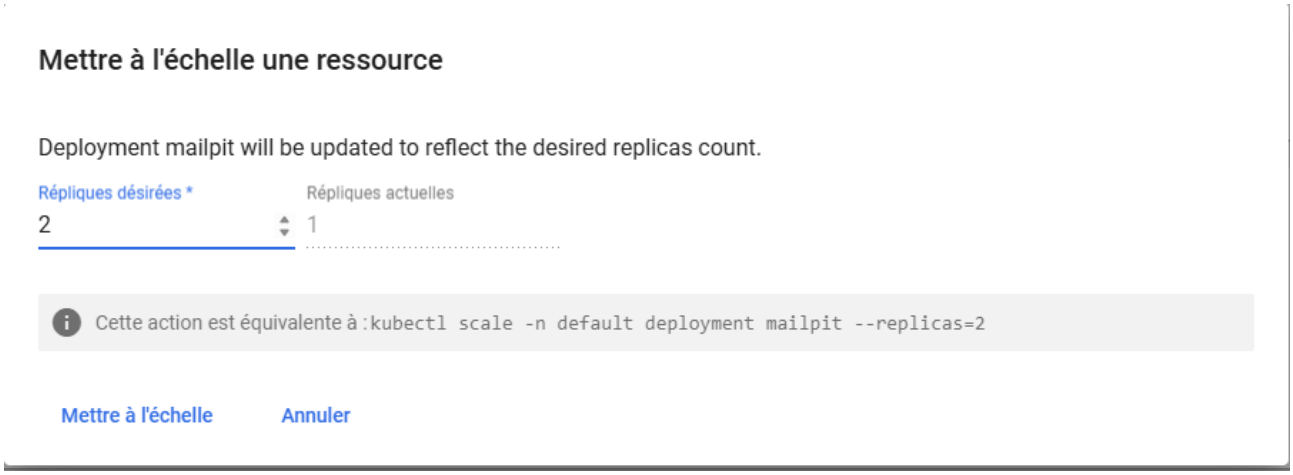

1 1 1
Workloads
Cron Jobs
Daemon Sets
Deployments
Jobs
Pods
Replica Sets
Replication Controllers
Stateful Sets
Service
Ingresses
Ingress Classes
Services
Config and Storage
Config Maps
Conditions
Type
Statut
Dernière sonde
Available
True
8 minutes ago
Progressing
True
8 minutes ago
Nouveau Replica Set
Nom
mailpit-5d8c9cd4
Espace de nom
default
Âge
8 minutes ago
Pods
1 / 1
Étiquettes
k8s-app: mailpit
pod-template-hash: 5d8c9cd4
Images
axllent/mailpit

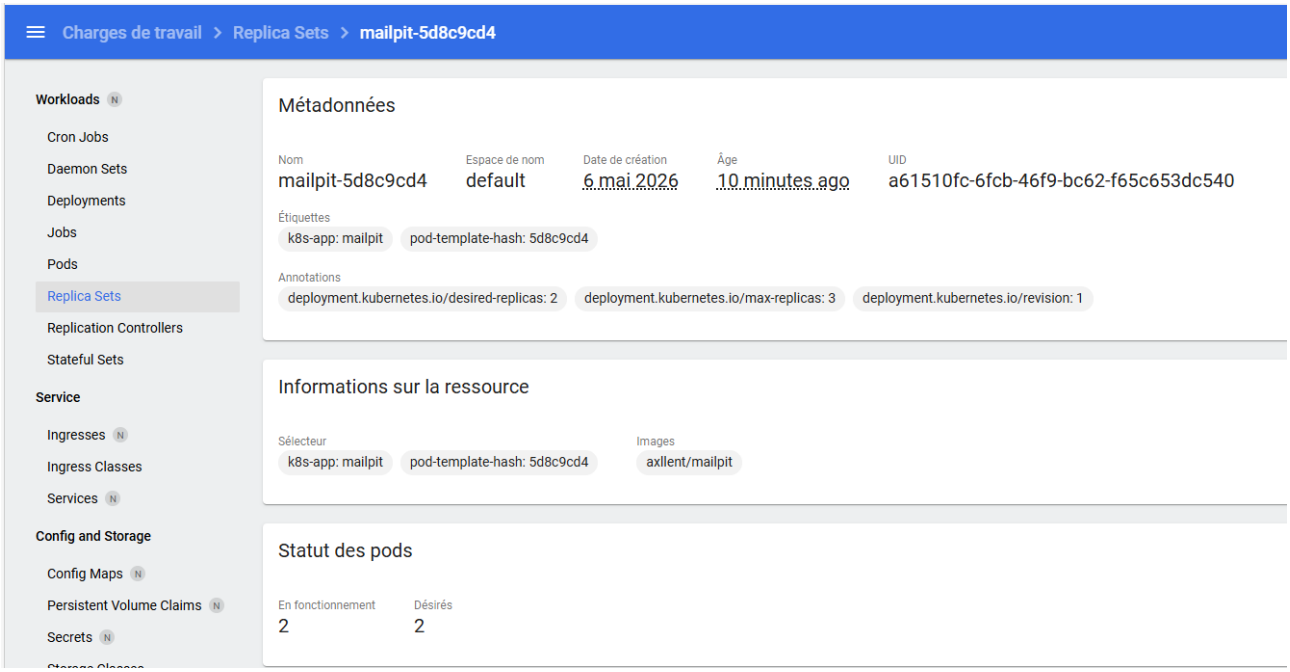

Workloads
Cron Jobs
Daemon Sets
Deployments
Jobs
Pods
Replica Sets
Replication Controllers
Stateful Sets
Service
Ingresses
Ingress Classes
Services
Config and Storage
Config Maps
Persistent Volume Claims
Secrets
Storage Classes
Cluster
Cluster Role Bindings
Cluster Roles
Events
Namespaces
Métadonnées
Nom
mailpit-5d8c9cd4
Espace de nom
default
Date de création
6 mai 2026
Âge
8 minutes ago
UID
a61510fc-6fcb-46f9-bc62-f65c653dc540
Étiquettes
k8s-app: mailpit
pod-template-hash: 5d8c9cd4
Annotations
deployment.kubernetes.io/desired-replicas: 1
deployment.kubernetes.io/max-replicas: 2
deployment.kubernetes.io/revision: 1
Informations sur la ressource
Sélecteur
k8s-app: mailpit
pod-template-hash: 5d8c9cd4
Images
axllent/mailpit
Statut des pods
En fonctionnement
1
Désirés
1
Pods
Nom
Images
Étiquettes
Noeud
Statut
Redémarrag
Utilisation CPU (coeurs)
Utilisation mémoire (octets)
Date de création
mailpit-5d8c9cd4-78qqn
axllent/mailpit
k8s-app: mailpit
pod-template-hash: 5d8c9cd4
minikube
Running
0
1,00m
7,09Mi
8 minutes ago

Voir les journaux :

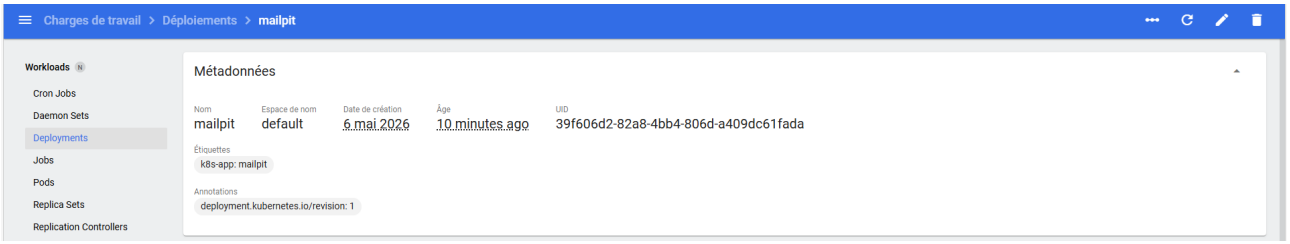


Scalabilité :




Charges de travail > Replica Sets > mailpit-5d8c9cd4
Workloads
Cron Jobs
Daemon Sets
Deployments
Jobs
Pods
Replica Sets
Replication Controllers
Stateful Sets
Service
Ingresses
Ingress Classes
Services
Config and Storage
Config Maps
Persistent Volume Claims
Secrets
Métadonnées
Nom
mailpit-5d8c9cd4
Espace de nom
default
Date de création
6 mai 2026
Âge
10 minutes ago
UID
a61510fc-6fcb-46f9-bc62-f65c653dc540
Étiquettes
k8s-app: mailpit
pod-template-hash: 5d8c9cd4
Annotations
deployment.kubernetes.io/desired-replicas: 2
deployment.kubernetes.io/max-replicas: 3
deployment.kubernetes.io/revision: 1
Informations sur la ressource
Sélecteur
k8s-app: mailpit
pod-template-hash: 5d8c9cd4
Images
axllent/mailpit
Statut des pods
En fonctionnement
2
Désirés
2

Mise à jour :


Charges de travail > Déploiements > mailpit
Workloads
Cron Jobs
Daemon Sets
Deployments
Jobs
Pods
Replica Sets
Replication Controllers
Métadonnées
Nom
mailpit
Espace de nom
default
Date de création
6 mai 2026
Âge
10 minutes ago
UID
39f606d2-82a8-4bb4-806d-a409dc61fada
Étiquettes
k8s-app: mailpit
Annotations
deployment.kubernetes.io/revision: 1

Éditer une ressource

YAML JSON

```yaml
kind: Deployment
apiVersion: apps/v1
metadata:
  name: mailpit
  namespace: default
  uid: 39f606d2-82a8-4bb4-806d-a409dc61fada
  resourceVersion: '3608'
  generation: 2
  creationTimestamp: '2026-05-06T11:24:31Z'
  labels:
    k8s-app: mailpit
  annotations:
    deployment.kubernetes.io/revision: '1'
  managedFields:
    - manager: dashboard
      operation: Update
      apiVersion: apps/v1
      fieldsType: FieldsV1
      fieldsV1:
        f:spec:
          f:replicas: {}
```

Cette action est équivalente à : `kubectl apply -f <spec.yaml>`

Mettre à jour Annuler

Éditer une ressource

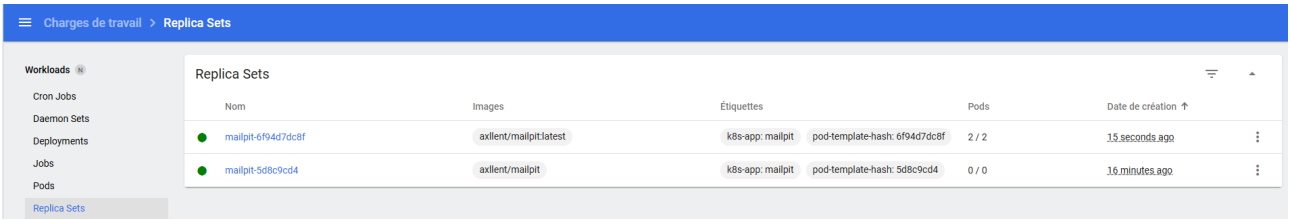
YAML JSON

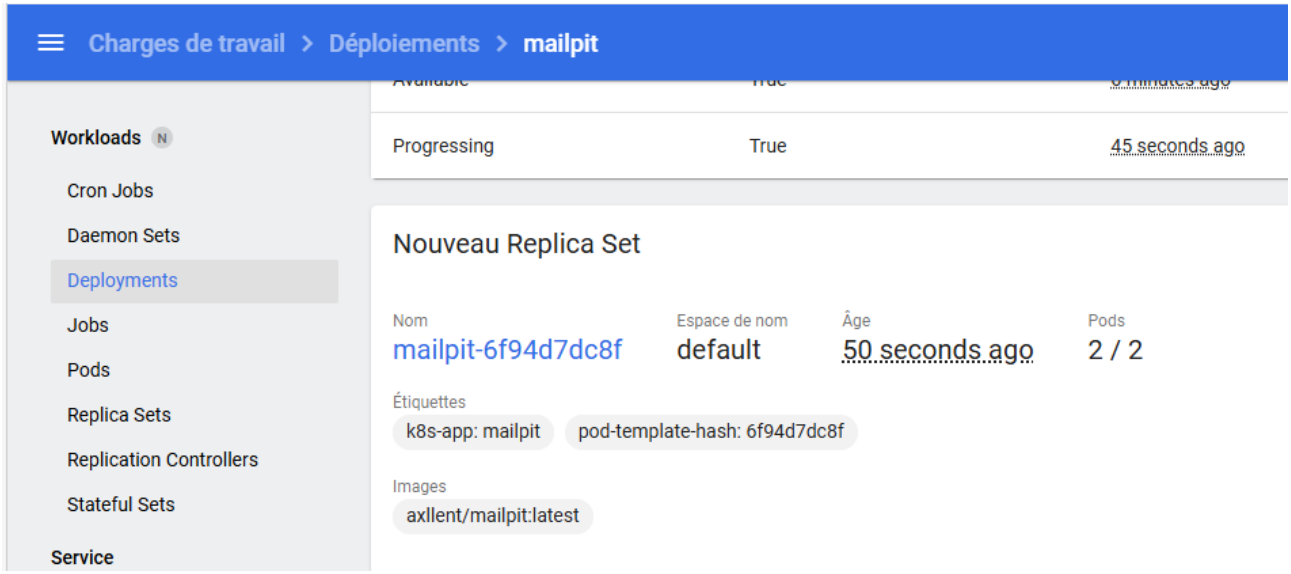
```yaml
spec:
  replicas: 2
  selector:
    matchLabels:
      k8s-app: mailpit
  template:
    metadata:
      name: mailpit
      labels:
        k8s-app: mailpit
    spec:
      containers:
        - name: mailpit
          image: axllent/mailpit:latest
          resources: {}
          terminationMessagePath: /dev/termination-log
          terminationMessagePolicy: File
          imagePullPolicy: Always
          securityContext:
            privileged: false
      restartPolicy: Always
```

Cette action est équivalente à : `kubectl apply -f <spec.yaml>`

Mettre à jour Annuler

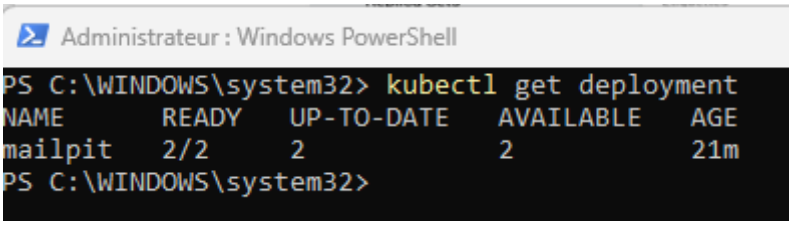
Kubernetes va créer un nouveau ReplicaSet :

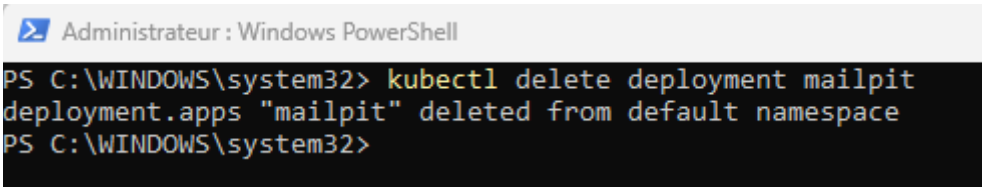


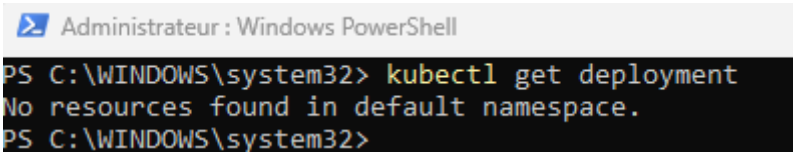


4. Créer un déploiement à l’aide de l’outil kubectl.

Suppression d’un déploiement :







Création d’un déploiement

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl create deployment mailpit --image=axllent/mailpit
deployment.apps/mailpit created
PS C:\WINDOWS\system32>
```

Etat du déploiement

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get deployment
NAME      READY   UP-TO-DATE   AVAILABLE   AGE
mailpit   1/1     1            1           24s
PS C:\WINDOWS\system32> kubectl get deployment -o wide
NAME      READY   UP-TO-DATE   AVAILABLE   AGE   CONTAINERS   IMAGES            SELECTOR
mailpit   1/1     1            1           32s   mailpit      axllent/mailpit   app=mailpit
PS C:\WINDOWS\system32>
```

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl describe deployment mailpit
Name:                   mailpit
Namespace:              default
CreationTimestamp:      Wed, 06 May 2026 15:14:27 +0200
Labels:                 app=mailpit
Annotations:            deployment.kubernetes.io/revision: 1
Selector:               app=mailpit
Replicas:               1 desired | 1 updated | 1 total | 1 available | 0 unavailable
StrategyType:           RollingUpdate
MinReadySeconds:        0
RollingUpdateStrategy:  25% max unavailable, 25% max surge
Pod Template:
  Labels:  app=mailpit
  Containers:
   mailpit:
    Image:         axllent/mailpit
    Port:          <none>
    Host Port:     <none>
    Environment:   <none>
    Mounts:        <none>
  Volumes:         <none>
  Node-Selectors:  <none>
  Tolerations:     <none>
Conditions:
  Type           Status  Reason
  ----           ------  ------
  Available      True    MinimumReplicasAvailable
  Progressing    True    NewReplicaSetAvailable
OldReplicaSets:  <none>
NewReplicaSet:   mailpit-7b96b48c5d (1/1 replicas created)
Events:
  Type    Reason             Age   From                   Message
  ----    ------             ----  ----                   -------
  Normal  ScalingReplicaSet  64s   deployment-controller  Scaled up replica set mailpit-7b96b48c5d from 0 to 1
PS C:\WINDOWS\system32>
```

Réplicas :

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get replicaset
NAME                DESIRED   CURRENT   READY   AGE
mailpit-7b96b48c5d   1         1         1       116s
PS C:\WINDOWS\system32> kubectl describe rs mailpit-7b96b48c5d
Name:           mailpit-7b96b48c5d
Namespace:      default
Selector:       app=mailpit,pod-template-hash=7b96b48c5d
Labels:         app=mailpit
                pod-template-hash=7b96b48c5d
Annotations:    deployment.kubernetes.io/desired-replicas: 1
                deployment.kubernetes.io/max-replicas: 2
                deployment.kubernetes.io/revision: 1
Controlled By:  Deployment/mailpit
Replicas:       1 current / 1 desired
Pods Status:    1 Running / 0 Waiting / 0 Succeeded / 0 Failed
Pod Template:
  Labels:  app=mailpit
           pod-template-hash=7b96b48c5d
  Containers:
   mailpit:
    Image:         axllent/mailpit
    Port:          <none>
    Host Port:     <none>
    Environment:   <none>
    Mounts:        <none>
  Volumes:         <none>
  Node-Selectors:  <none>
  Tolerations:     <none>
Events:
  Type    Reason            Age    From                   Message
  ----    ------            ----   ----                   -------
  Normal  SuccessfulCreate  2m25s  replicaset-controller  Created pod: mailpit-7b96b48c5d-wb5pm
PS C:\WINDOWS\system32>
```

Etat du pod

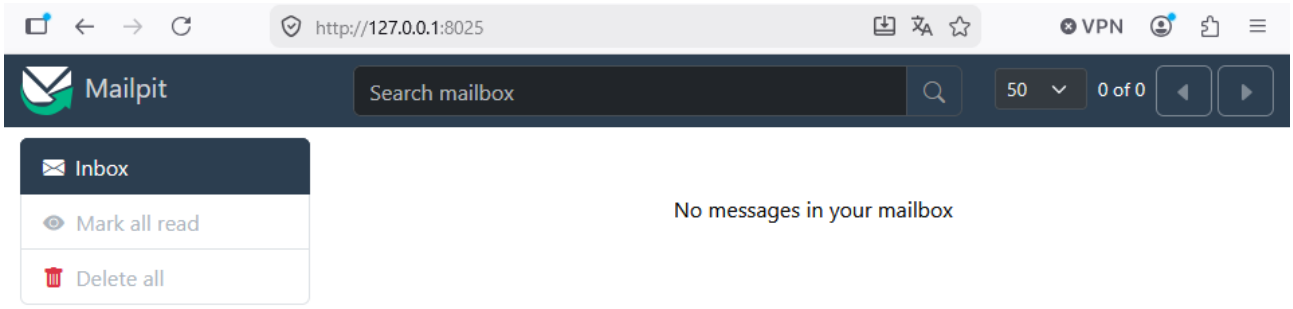
```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get pods
NAME                      READY   STATUS    RESTARTS   AGE
mailpit-7b96b48c5d-wb5pm   1/1     Running   0          3m9s
PS C:\WINDOWS\system32> kubectl describe pods mailpit-7b96b48c5d-wb5pm
Name:             mailpit-7b96b48c5d-wb5pm
Namespace:        default
Priority:         0
Service Account:  default
Node:             minikube/172.25.34.187
Start Time:       Wed, 06 May 2026 15:14:27 +0200
Labels:           app=mailpit
                  pod-template-hash=7b96b48c5d
Annotations:      <none>
Status:           Running
IP:               10.244.0.11
IPs:
  IP:           10.244.0.11
Controlled By:  ReplicaSet/mailpit-7b96b48c5d
Containers:
  mailpit:
    Container ID:   docker://61be2befb0f650d3701cc9b5b8ae8c5a96441e53f07da02b3ef4700ab0ccde20
    Image:          axllent/mailpit
    Image ID:       docker-pullable://axllent/mailpit@sha256:757f22b56c1da03570afdb3d259effe5091018008a81bbedc8158cee7
e16fdbc
    Port:           <none>
    Host Port:      <none>
    State:          Running
      Started:      Wed, 06 May 2026 15:14:29 +0200
    Ready:          True
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-g7xg8 (ro)
Conditions:
  Type                        Status
  PodReadyToStartContainers   True
```

Accès aux logs du pod et des conteneurs

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl logs mailpit-7b96b48c5d-wb5pm
time="2026/05/06 13:14:29" level=info msg="[smtpd] starting on [::]:1025 (no encryption)"
time="2026/05/06 13:14:29" level=info msg="[cors] allowed API origins: "
time="2026/05/06 13:14:29" level=info msg="[http] starting on [::]:8025"
time="2026/05/06 13:14:29" level=info msg="[http] accessible via http://localhost:8025/"
PS C:\WINDOWS\system32> kubectl logs mailpit-7b96b48c5d-wb5pm -c mailpit
time="2026/05/06 13:14:29" level=info msg="[smtpd] starting on [::]:1025 (no encryption)"
time="2026/05/06 13:14:29" level=info msg="[cors] allowed API origins: "
time="2026/05/06 13:14:29" level=info msg="[http] starting on [::]:8025"
time="2026/05/06 13:14:29" level=info msg="[http] accessible via http://localhost:8025/"
PS C:\WINDOWS\system32>
```

Accès à l'application Mailpit

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl port-forward deployment/mailpit 8025
Forwarding from 127.0.0.1:8025 -> 8025
Forwarding from [::1]:8025 -> 8025
Handling connection for 8025
Handling connection for 8025
Handling connection for 8025
```




```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl expose deployment/mailpit --port 1025,8025
service/mailpit exposed
PS C:\WINDOWS\system32>
```

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl exec -it mailpit-7b96b48c5d-wb5pm -- sh
/ # getent hosts mailpit
10.109.45.94      mailpit.default.svc.cluster.local  mailpit.default.svc.cluster.local mailpit
/ #
```

Lancement d’un pod de test :

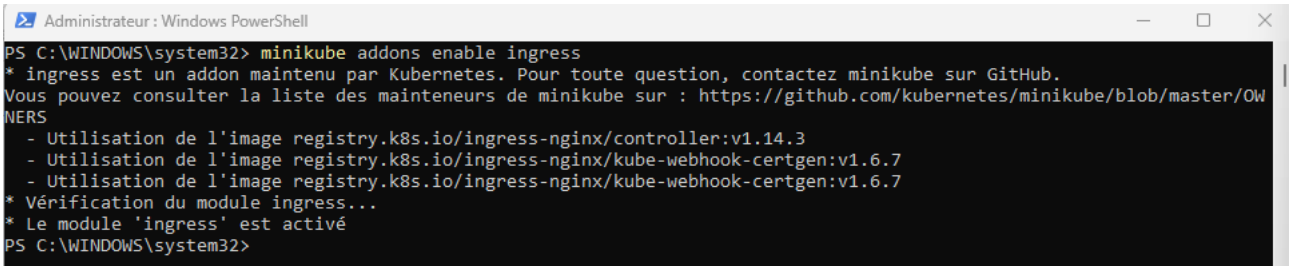
```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl run -it --rm pod-test --image=alpine sh
All commands and output from this session will be recorded in container logs, including credentials and sensitive info
rmation passed through the command prompt.
If you don't see a command prompt, try pressing enter.
/ # nslookup mailpit
Server:         10.96.0.10
Address:        10.96.0.10:53

** server can't find mailpit.cluster.local: NXDOMAIN

Name:   mailpit.default.svc.cluster.local
Address: 10.109.45.94


** server can't find mailpit.cluster.local: NXDOMAIN

** server can't find mailpit.svc.cluster.local: NXDOMAIN

** server can't find mailpit.svc.cluster.local: NXDOMAIN

/ # exit
Session ended, resume using 'kubectl attach pod-test -c pod-test -i -t' command when the pod is running
pod "pod-test" deleted from default namespace
PS C:\WINDOWS\system32>
```

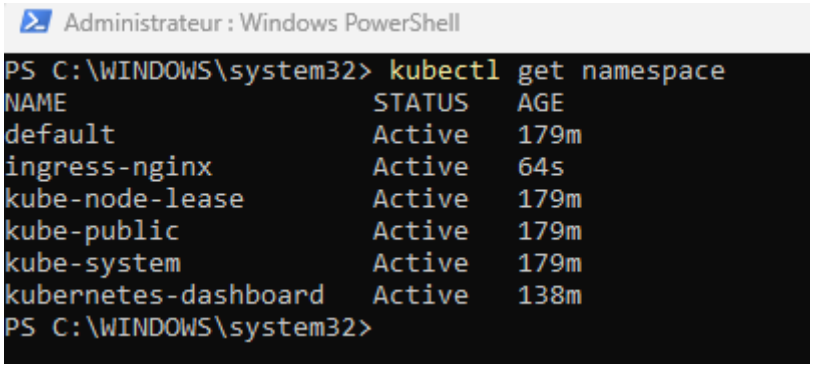
Résilience et scalabilité (augmenter le niveau de résilience d’une application et augmenter la capacité de trafic d’une application pour répondre à des contraintes de charge)

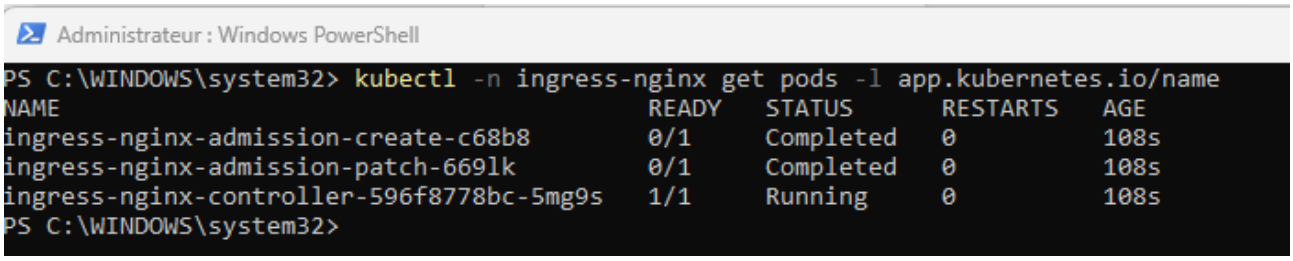
```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl scale deployment mailpit --replicas=2
deployment.apps/mailpit scaled
PS C:\WINDOWS\system32>
```

```
Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get deployment mailpit
NAME      READY   UP-TO-DATE   AVAILABLE   AGE
mailpit   2/2     2            2           14m
PS C:\WINDOWS\system32> kubectl get pods -l app=mailpit
NAME                       READY   STATUS    RESTARTS   AGE
mailpit-7b96b48c5d-wb5pm   1/1     Running   0          14m
mailpit-7b96b48c5d-xb6q2   1/1     Running   0          46s
PS C:\WINDOWS\system32>
```

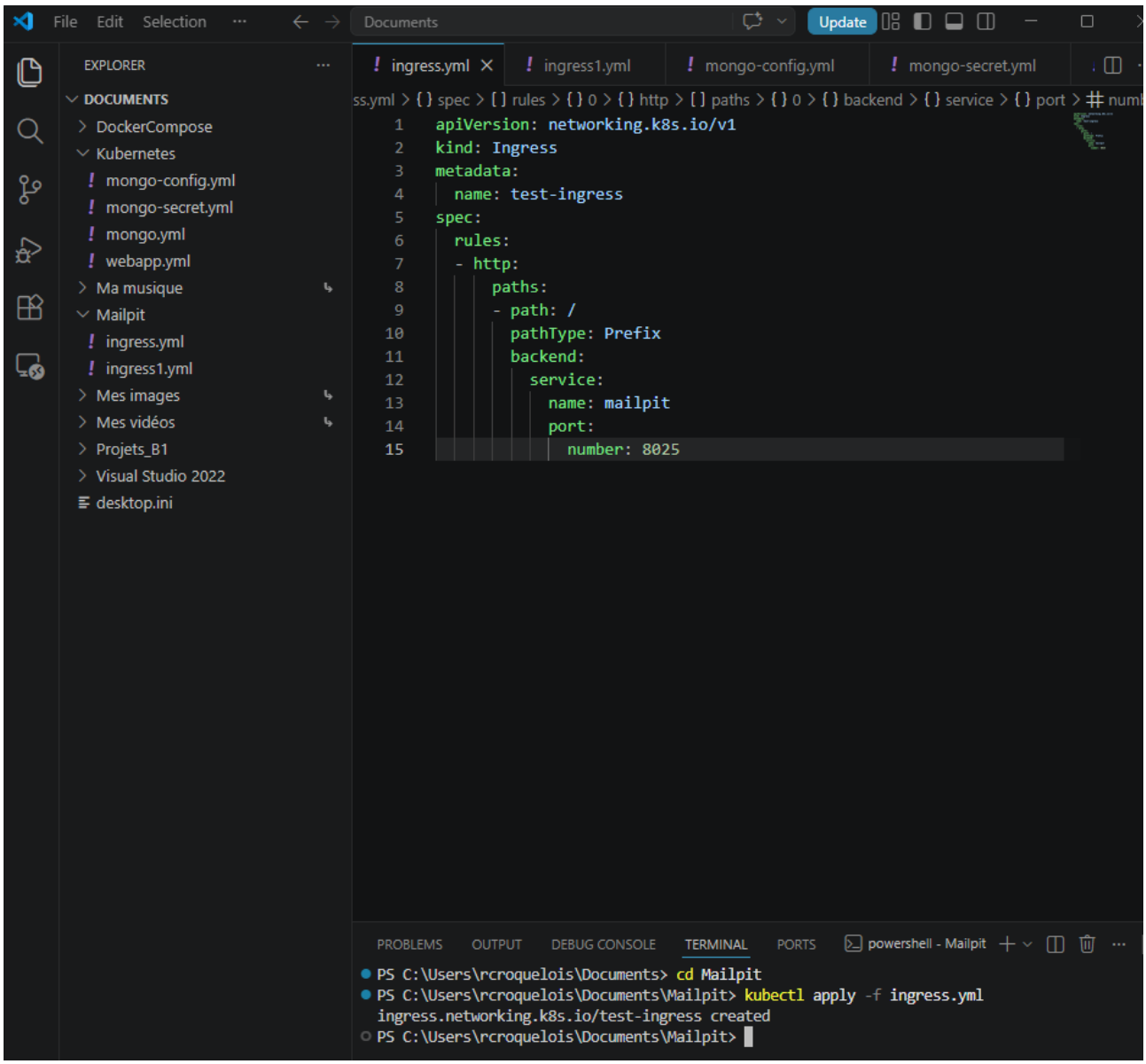
Activation du contrôleur Ingress dans Minikube :

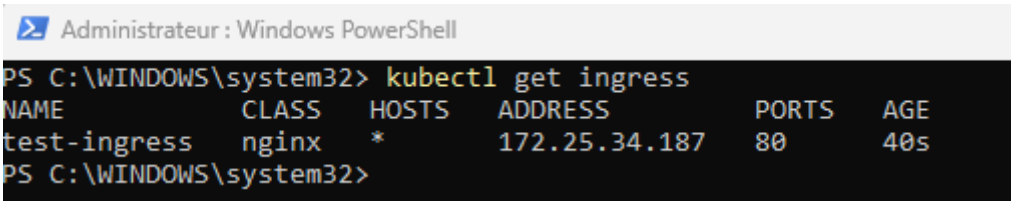


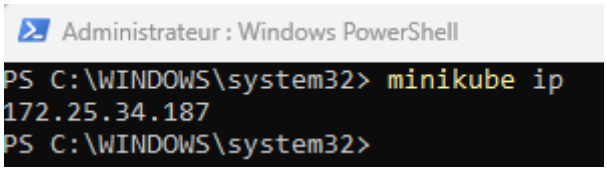


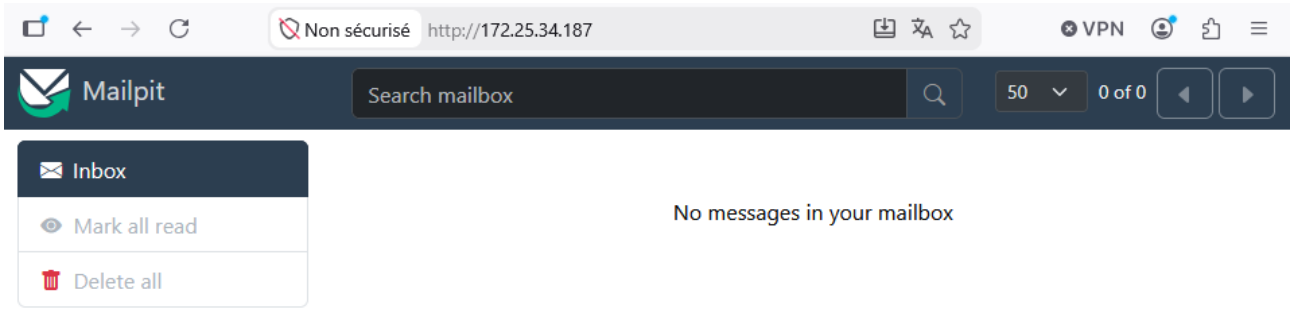


Déclaration d’une règle Ingress et prise en compte du fichier YAML :


File Edit Selection
Documents
Update
EXPLORER
DOCUMENTS
DockerCompose
Kubernetes
mongo-config.yml
mongo-secret.yml
mongo.yml
webapp.yml
Ma musique
Mailpit
ingress.yml
ingress1.yml
Mes images
Mes vidéos
Projets_B1
Visual Studio 2022
desktop.ini
ingress.yml
ingress1.yml
mongo-config.yml
mongo-secret.yml
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
name: test-ingress
spec:
rules:
- http:
paths:
- path: /
pathType: Prefix
backend:
service:
name: mailpit
port:
number: 8025
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
powershell - Mailpit
PS C:\Users\rcroquelois\Documents> cd Mailpit
PS C:\Users\rcroquelois\Documents\Mailpit> kubectl apply -f ingress.yml
ingress.networking.k8s.io/test-ingress created
PS C:\Users\rcroquelois\Documents\Mailpit>

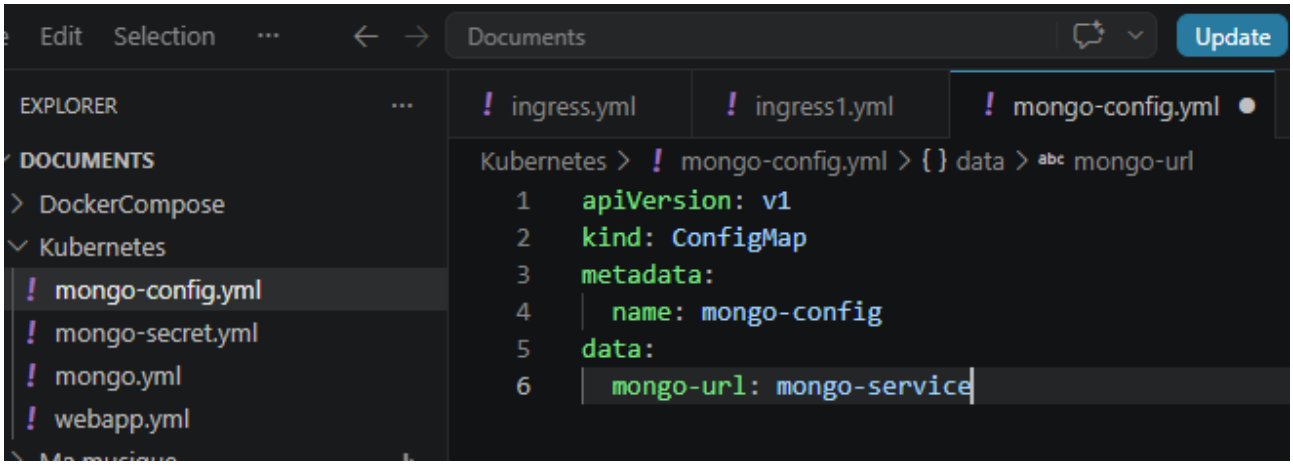

Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> kubectl get ingress
NAME CLASS HOSTS ADDRESS PORTS AGE
test-ingress nginx * 172.25.34.187 80 40s
PS C:\WINDOWS\system32>


Administrateur : Windows PowerShell
PS C:\WINDOWS\system32> minikube ip
172.25.34.187
PS C:\WINDOWS\system32>

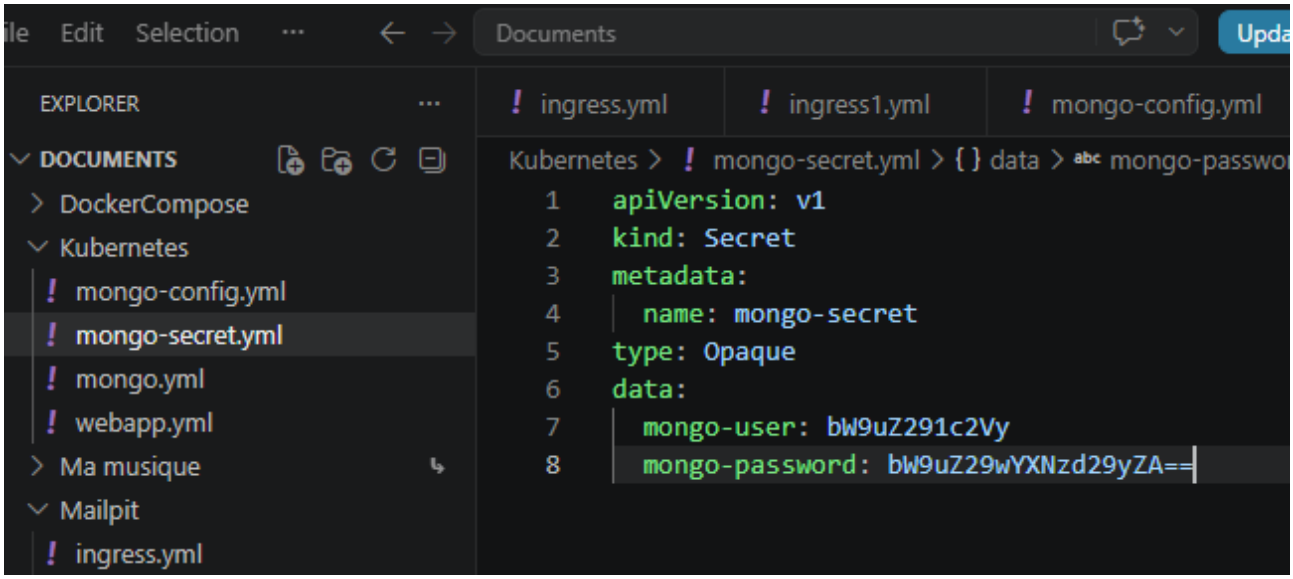


5. Automatisation de déploiement par fichier YAML.

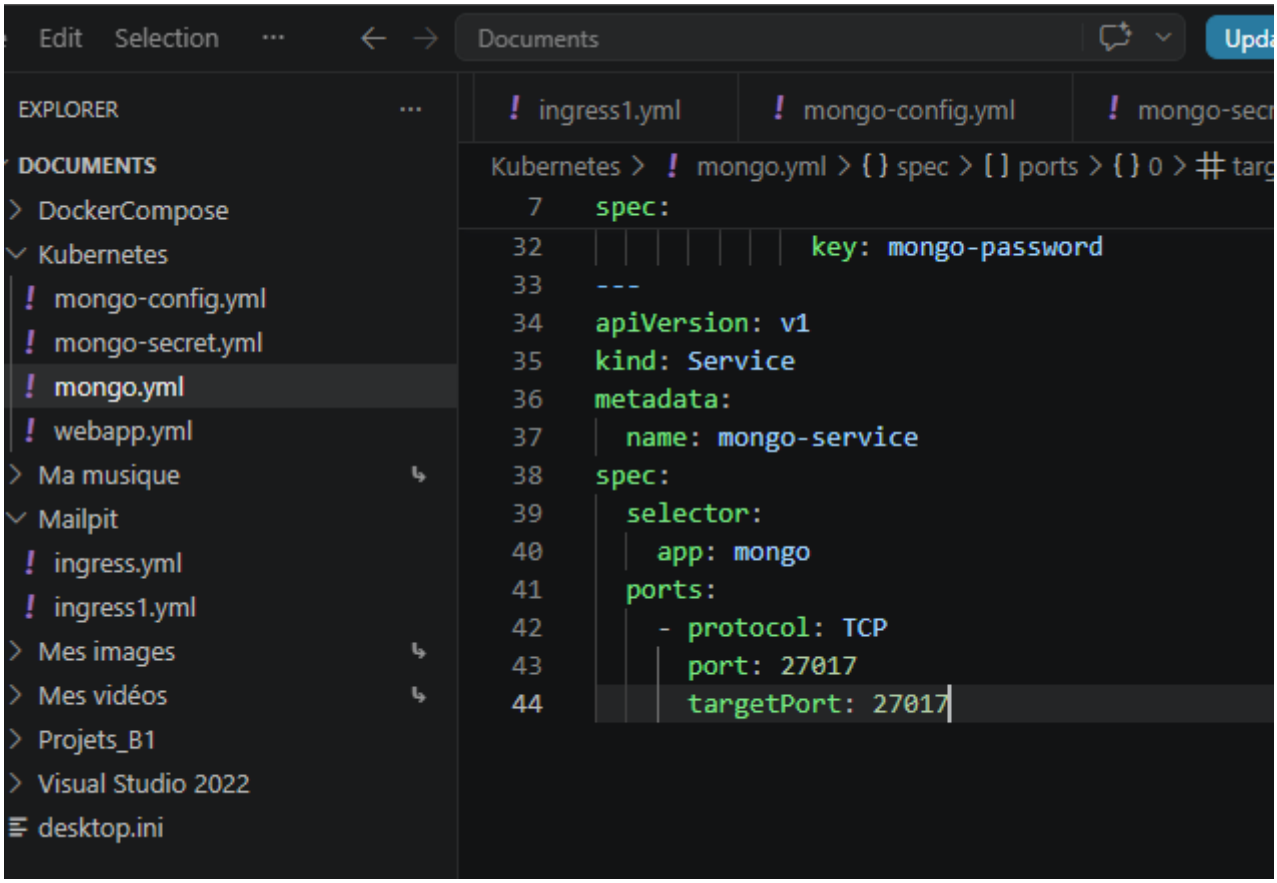
Composant de type ConfigMap :



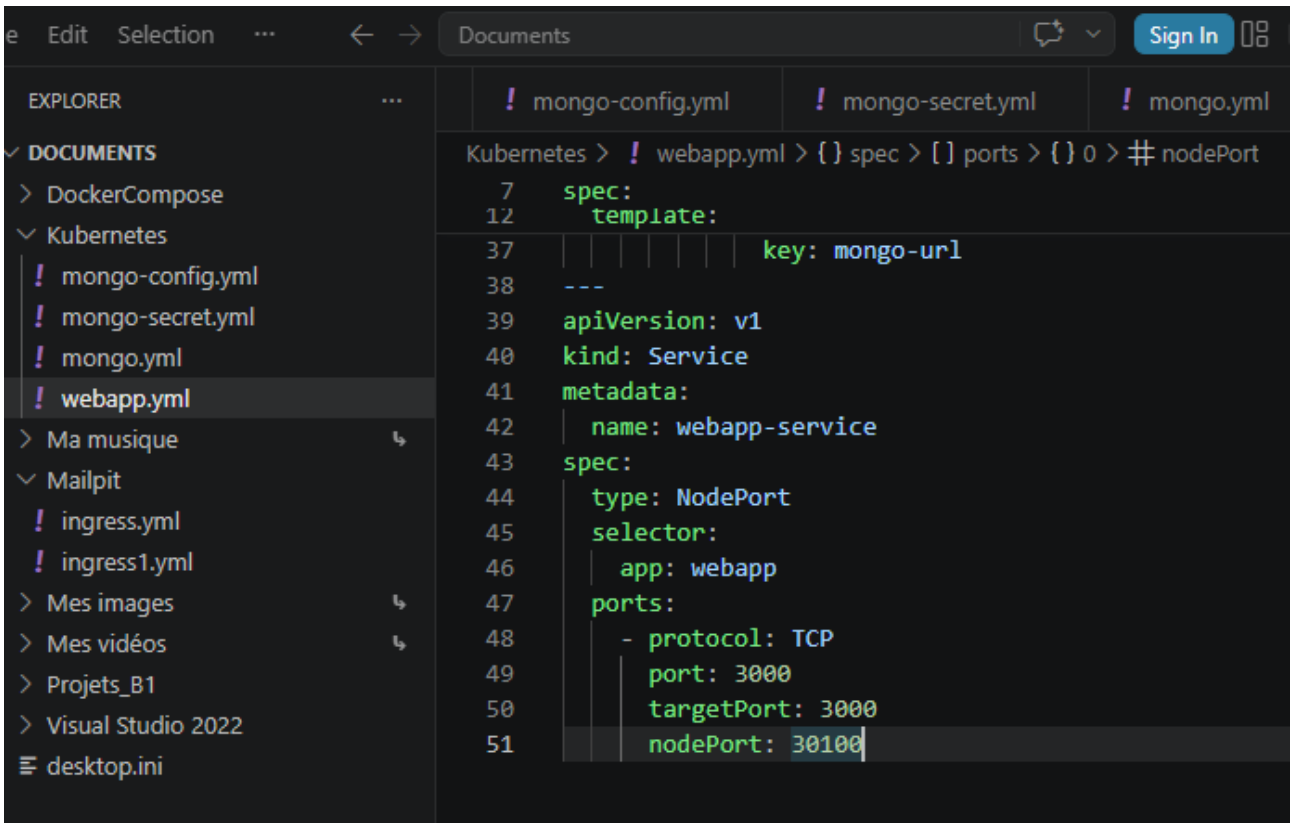
Composant de type Secret :



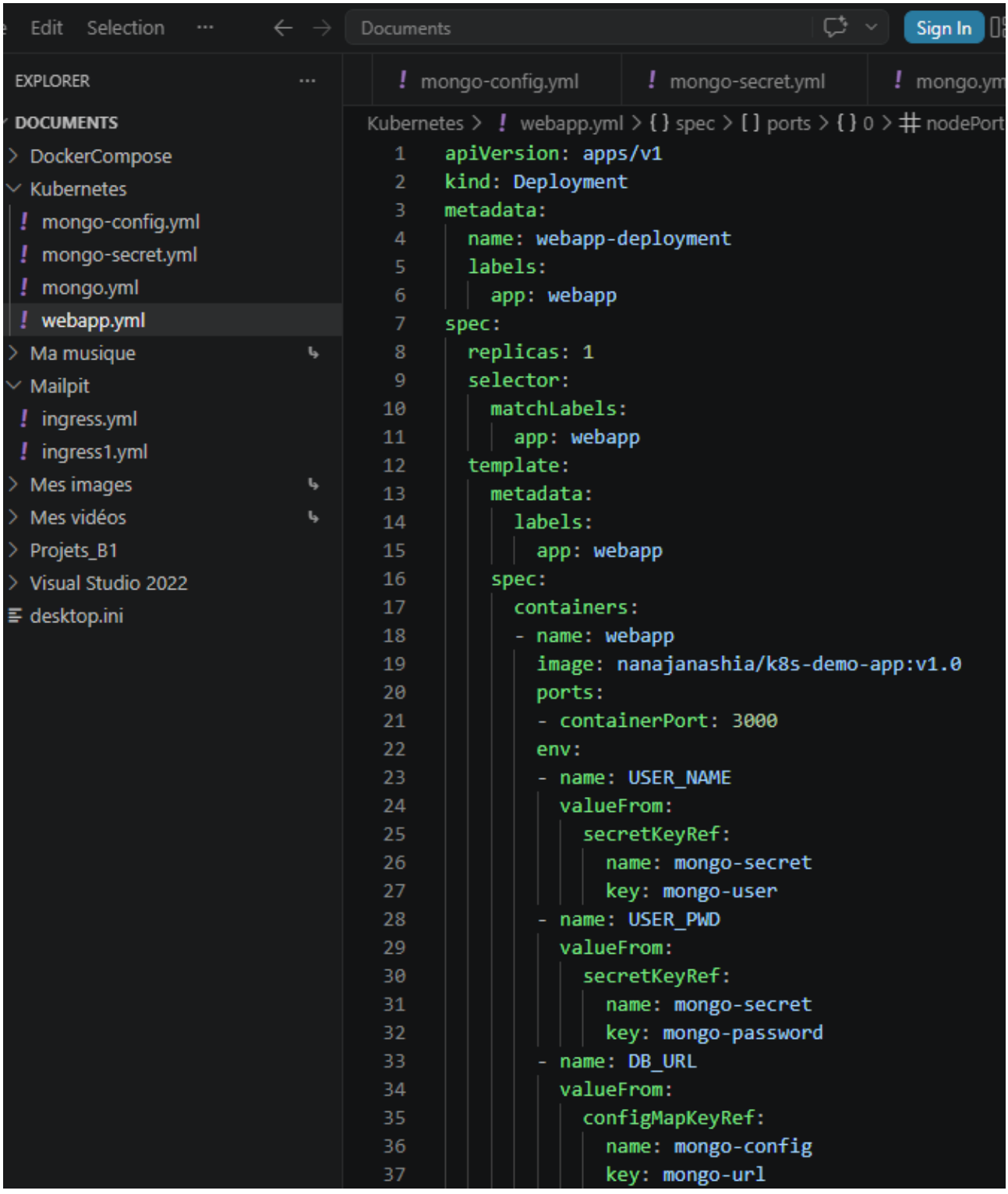
Créer un service interne : service qui va permettre la communication entre le pod front et le pod de la base de données



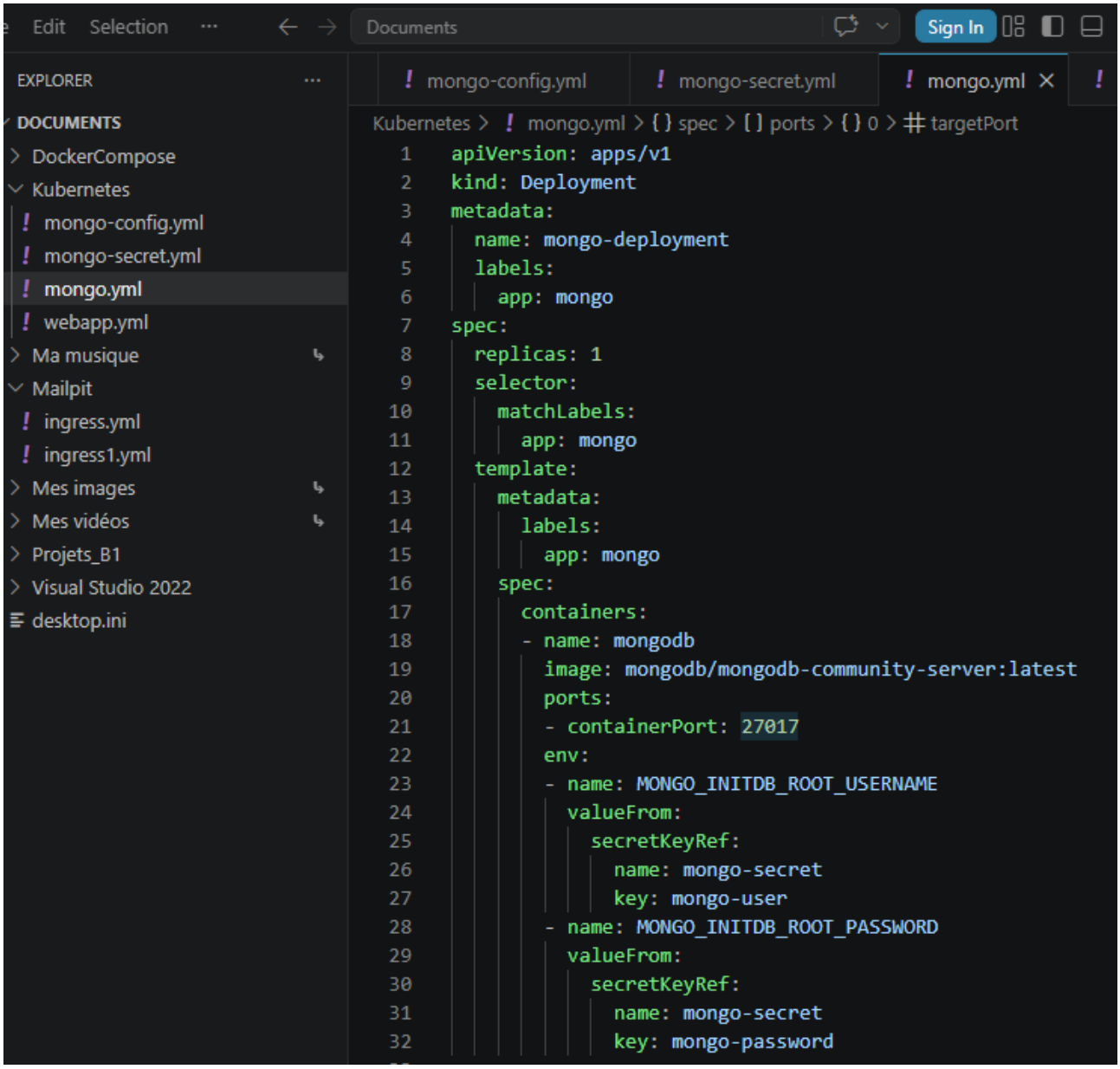
Créer un service externe : pod du front accessible depuis l’extérieur du cluster Kubernetes



Déployer l’application du pod front (webapp) : créer un composant de type deployment



Déployer l’application mongo :



Procéder à la création des composants en appliquant la commande kubectl apply -f aux 4 fichiers YAML dans l'ordre figurant ci-dessous :

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS  powershell - Kubernetes
PS C:\Users\rcroquelois\Documents\Kubernetes> kubectl apply -f mongo-config.yml
configmap/mongo-config created
PS C:\Users\rcroquelois\Documents\Kubernetes> kubectl apply -f mongo-secret.yml
secret/mongo-secret created
PS C:\Users\rcroquelois\Documents\Kubernetes> kubectl apply -f mongo.yml
deployment.apps/mongo-deployment created
service/mongo-service created
PS C:\Users\rcroquelois\Documents\Kubernetes> kubectl apply -f webapp.yml
deployment.apps/webapp-deployment created
service/webapp-service created
PS C:\Users\rcroquelois\Documents\Kubernetes>
```

Lister les objets créés :

```
PROBLEMS  OUTPUT  TERMINAL  ...  powershell - Kubernetes

PS C:\Users\rcroquelois\Documents\Kubernetes> kubectl get all
NAME                                    READY   STATUS              RESTARTS   AGE
pod/mailpit-78f8f9dbbb-864mn            0/1     ImagePullBackOff    0          7m3s
pod/mongo-deployment-744864fdd7-g7zzf   1/1     Running             0          47s
pod/webapp-deployment-5766fd95c7-56kj6  0/1     ContainerCreating   0          37s

NAME                     TYPE        CLUSTER-IP     EXTERNAL-IP   PORT(S)          AGE
service/kubernetes       ClusterIP   10.96.0.1      <none>        443/TCP          13m
service/mongo-service    ClusterIP   10.96.40.63    <none>        27017/TCP        47s
service/webapp-service   NodePort    10.103.99.10   <none>        3000:30100/TCP   37s

NAME                                READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/mailpit             0/1     1            0           7m3s
deployment.apps/mongo-deployment    1/1     1            1           47s
deployment.apps/webapp-deployment   0/1     1            0           37s

NAME                                          DESIRED   CURRENT   READY   AGE
replicaset.apps/mailpit-78f8f9dbbb            1         1         0       7m3s
replicaset.apps/mongo-deployment-744864fdd7   1         1         1       47s
replicaset.apps/webapp-deployment-5766fd95c7  1         1         0       37s
PS C:\Users\rcroquelois\Documents\Kubernetes>
```

Lister les autres objets (configMap et Secret) :

```
PROBLEMS  OUTPUT  TERMINAL  ...                powershell - Kubernetes
PS C:\Users\rcroquelois\Documents\Kubernetes> kubectl get configmap
NAME               DATA   AGE
kube-root-ca.crt   1      14m
mongo-config       1      119s
PS C:\Users\rcroquelois\Documents\Kubernetes> kubectl get secret
NAME           TYPE     DATA   AGE
mongo-secret   Opaque   2      117s
PS C:\Users\rcroquelois\Documents\Kubernetes>
```

Décrire le service webapp-service :

```
PROBLEMS  OUTPUT  TERMINAL  ...                powershell - Kubernetes
PS C:\Users\rcroquelois\Documents\Kubernetes> kubectl describe service webapp-service
Name:                     webapp-service
Namespace:                default
Labels:                   <none>
Annotations:              <none>
Selector:                 app=webapp
Type:                     NodePort
IP Family Policy:         SingleStack
IP Families:              IPv4
IP:                       10.103.99.10
IPs:                      10.103.99.10
Port:                     <unset>  3000/TCP
TargetPort:               3000/TCP
NodePort:                 <unset>  30100/TCP
Endpoints:                10.244.0.16:3000
Session Affinity:         None
External Traffic Policy:  Cluster
Internal Traffic Policy:  Cluster
Events:                   <none>
PS C:\Users\rcroquelois\Documents\Kubernetes>
```

Décrire le pod associé :

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS
PS C:\Users\rcroquelois\Documents\Kubernetes> kubectl describe pod webapp-deployment-5766fd95c7-56kj6
Name:             webapp-deployment-5766fd95c7-56kj6
Namespace:        default
Priority:         0
Service Account:  default
Node:             minikube/172.27.123.18
Start Time:       Thu, 07 May 2026 12:37:27 +0200
Labels:           app=webapp
                  pod-template-hash=5766fd95c7
Annotations:      <none>
Status:           Running
IP:               10.244.0.16
IPs:
  IP:           10.244.0.16
Controlled By:  ReplicaSet/webapp-deployment-5766fd95c7
Containers:
  webapp:
    Container ID:   docker://4a8abeed0db15137d3f1c4d06743d4bd5fad6c9889001e09c1e1f3c032d160e9
    Image:          nanajanashia/k8s-demo-app:v1.0
    Image ID:       docker-pullable://nanajanashia/k8s-demo-app@sha256:6f554135da39ac00a1c2f43e44c2b0b54ca13d3d8044da969361e7781adb7f95
    Port:           3000/TCP
    Host Port:      0/TCP
    State:          Running
      Started:      Thu, 07 May 2026 12:38:09 +0200
    Ready:          True
    Restart Count:  0
    Environment:
      USER_NAME:  <set to the key 'mongo-user' in secret 'mongo-secret'>      Optional: false
      USER_PWD:   <set to the key 'mongo-password' in secret 'mongo-secret'>  Optional: false
      DB_URL:     <set to the key 'mongo-url' of config map 'mongo-config'>   Optional: false
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-l7sh8 (ro)
Conditions:
  Type                        Status
  PodReadyToStartContainers   True
  Initialized                 True
  Ready                       True
  ContainersReady             True
  PodScheduled                True
```

Consulter les logs de ce pod :

```
PROBLEMS  OUTPUT  TERMINAL  ...                kubectl - Kubernetes
PS C:\Users\rcroquelois\Documents\Kubernetes> kubectl get pod
NAME                                READY   STATUS             RESTARTS   AGE
mailpit-78f8f9dbbb-864mn            0/1     ImagePullBackOff   0          12m
mongo-deployment-744864fdd7-g7zzf   1/1     Running            0          6m36s
webapp-deployment-5766fd95c7-56kj6  1/1     Running            0          6m26s
PS C:\Users\rcroquelois\Documents\Kubernetes> kubectl logs webapp-deployment-5766fd95c7-56k
j6
app listening on port 3000!
PS C:\Users\rcroquelois\Documents\Kubernetes> kubectl logs webapp-deployment-5766fd95c7-56k
j6 -f
app listening on port 3000!
```

Lister les services :

```
PROBLEMS  OUTPUT  TERMINAL  ...                    powershell - Kubernetes

PS C:\Users\rcroquelois\Documents\Kubernetes> kubectl get service
NAME              TYPE        CLUSTER-IP      EXTERNAL-IP   PORT(S)          AGE
kubernetes        ClusterIP   10.96.0.1       <none>        443/TCP          21m
mongo-service     ClusterIP   10.96.40.63     <none>        27017/TCP        8m50s
webapp-service    NodePort    10.103.99.10    <none>        3000:30100/TCP   8m40s
PS C:\Users\rcroquelois\Documents\Kubernetes>
```

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

PS C:\Users\rcroquelois\Documents\Kubernetes> kubectl get node
NAME       STATUS   ROLES           AGE   VERSION
minikube   Ready    control-plane   22m   v1.35.1
PS C:\Users\rcroquelois\Documents\Kubernetes> kubectl get node -o wide
NAME       STATUS   ROLES           AGE   VERSION   INTERNAL-IP     EXTERNAL-IP   OS-IMAGE           KERNEL-VERSION   CONTAINER-RUNTIME
minikube   Ready    control-plane   22m   v1.35.1   172.27.123.18   <none>        Buildroot 2025.02   6.6.95           docker://28.5.2
PS C:\Users\rcroquelois\Documents\Kubernetes>
```

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

PS C:\Users\rcroquelois\Documents\Kubernetes> kubectl get svc -o wide
NAME             TYPE        CLUSTER-IP      EXTERNAL-IP   PORT(S)          AGE   SELECTOR
kubernetes       ClusterIP   10.96.0.1       <none>        443/TCP          24m   <none>
mongo-service    ClusterIP   10.96.40.63     <none>        27017/TCP        11m   app=mongo
webapp-service   NodePort    10.103.99.10    <none>        3000:30100/TCP   10m   app=webapp
PS C:\Users\rcroquelois\Documents\Kubernetes> kubectl get pod -o wide
NAME                                READY   STATUS             RESTARTS   AGE   IP            NODE       NOMINATED NODE   READINESS GATES
mailpit-78f8f9dbbb-864mn            0/1     ImagePullBackOff   0          17m   10.244.0.11   minikube   <none>           <none>
mongo-deployment-744864fdd7-g7zzf   1/1     Running            0          11m   10.244.0.15   minikube   <none>           <none>
webapp-deployment-5766fd95c7-56kj6  1/1     Running            0          10m   10.244.0.16   minikube   <none>           <none>
PS C:\Users\rcroquelois\Documents\Kubernetes>
```

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Email: **anna.smith@example.com**

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